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PERFECT CONCRETE PAVEMENTS OFFER IDEAL CONDITIONS FOR MOTORING.

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Living has come to depend largely on engineering, which might be broadly defined as the application of intelligence to the work of mankind. Its problems are never solved by militant methods, but by thought and experiment. War is carried on largely with the aid of engineers and engineering knowledge and apparatus. The engineering profession is therefore deeply concerned in it. To the medical profession war is an opportunity, to the engineering profession a disgrace. It will not long consent to be ruled by militant racial egotism.

JOHN NORMALAND.

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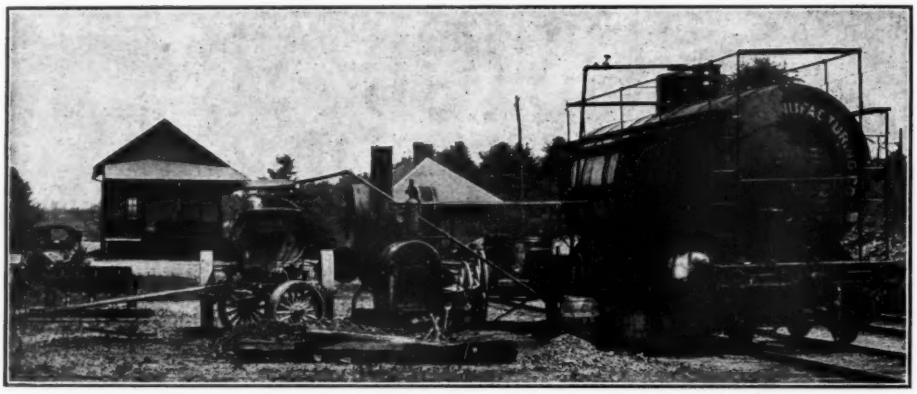


TANK CAR HEATED BY STEAM FROM BOILER AND UNLOADED BY STEAM PUMP TAKING THE TAR THRU DOME OF TANK CAR FOR MASSACHUSETTS HIGHWAY COMMISSION AT PONDVILLE.

METHODS *of* UNLOADING TANK CARS

By Philip P. Sharples.

The author of this practical paper speaks from his daily experience in solving engineering problems of the Barrett Manufacturing Company, and he can therefore give a broad view of the subject and many suggestions of details which can be utilized by others in designing their plants of the same nature.

TANK cars are now almost universally used for the delivery of bituminous road materials wherever the size of the job and the nature of the bituminous material admit of bulk shipments. The economy and dispatch of tank methods make them preferred wherever possible.

The use of bituminous materials, both as dust layers and as binders, has become so common, especially in the large cities, that many municipalities have fitted up plants especially for handling and storing oils, asphalts and refined tars. Such a plant consists of storage tanks and heating boilers, conveniently arranged beside a railroad siding.

Storage tanks should be provided in numbers sufficient to accommodate the different classes of tars or oils to be used at one time. The tanks should preferably be of 12,000 gallons capacity, to accommodate a full tank car of 10,000 gallons, with a leeway of 2,000 gallons to insure extra capacity enough to prevent demurrage if a new tank car arrives before the previous one is exhausted.

The tanks should be provided with sufficient steam coils to heat a charge from air temperature up to 200 degrees in twelve to fourteen hours. Under ordinary circumstances ten to twelve lengths of 1¼-inch pipe, kept well down on the bottom of the tank, will be sufficient. A 15 to 20-horse-power boiler, carrying 80 pounds of steam, will be necessary. To effect economy of heat it is desirable to lag the tanks.

If pumps are required, the boiler will also provide steam for the pumps. Steam

STORAGE TANK *in city yards at Springfield, Mass. Tar or oil flows by gravity from tank car to storage tanks. Auto truck or tank wagon is filled by gravity from storage tank.*

pumps with large clearances and metal valves should be chosen. Rubber valves would soon rot out.

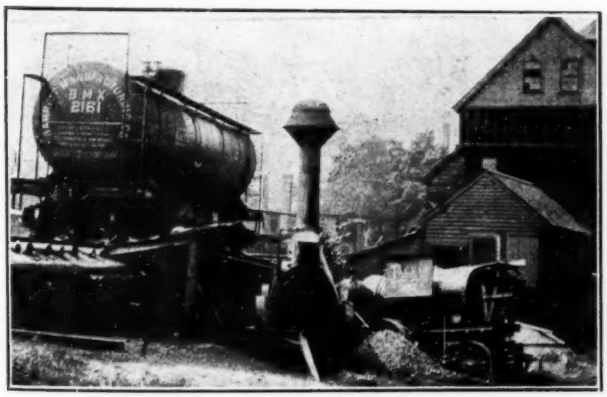
The city of Springfield, Mass., has a well-arranged plant of this character. Two storage tanks are provided, mounted on concrete stirrups high enough to allow a tank wagon or auto truck tank to back under the loading spout and load by gravity. Fortunately, the railroad at this point is sufficiently elevated to allow the bituminous material to flow also by gravity into the storage tank, thus dispensing with pumps altogether.

Instead, however, of a well-arranged stationary plant, the engineer is usually confronted with the problem of heating and distributing the bituminous material from some inconveniently located siding.

If possible, a raised siding or trestle should be sought, of sufficient clearance to allow a tank wagon to be filled by gravity. By digging a pit for the tank wagon to back into, sufficient head may often be obtained where otherwise impossible. A pipe is then used to convey the tar or oil to the tank wagon or a trough is built of wood and lined with tin or heavy building paper. With the binders and hot-surfacing materials a heating plant is necessary of 15 to 20-horse-power, giving 80 pounds pressure. Tank cars for shipping bituminous materials which require heating should be equipped with steam coils capable of heating the contents up to 200 degrees Fahrenheit in twelve to eighteen hours. During the autumn care should be taken to select a site for heating tank cars protected from the cold winds. Neglect of this precaution often leads to difficulty in obtaining material hot enough to work properly.

Cars set on level sidings must be pumped out or the contents forced out in some way. Thin oils and tars present no great difficulty. Many forms of pumps will handle them

PLANT FOR HEATING REFINED TAR *at Nashua, N. H. Tank wagon is backed into pit sunk so as to get gravity flow.*

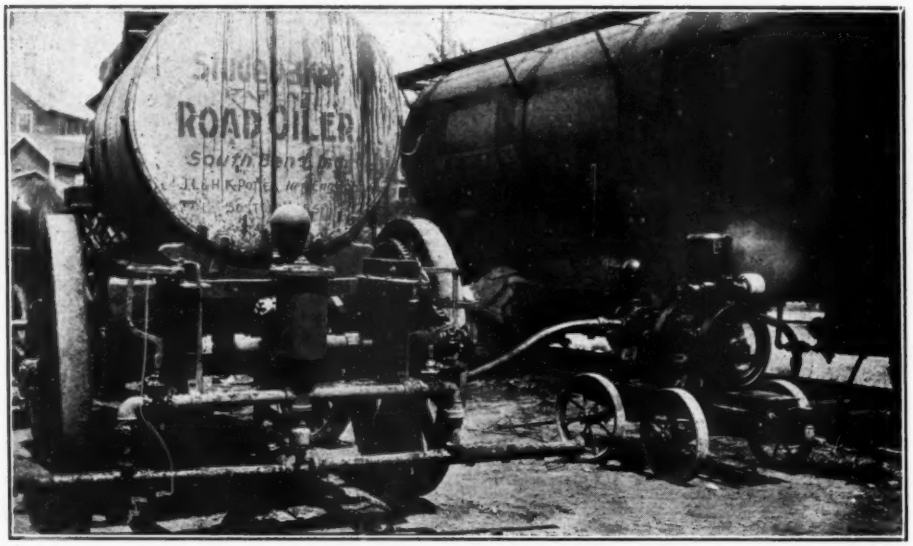


without difficulty, and the pump may be set to take out of the outlet cock on the bottom of the tank car, or the intake pipe may be lowered thru the dome. In selecting a pump, one without rubber packing should be chosen, since both oils and tars destroy rubber very quickly. Metal valves can now be had on hand, steam and rotary pumps suitable for the purpose. A 2½-inch intake and a 2-inch outlet are desirable sizes of piping.

Outfits are also available run by gasoline engines, that are handy and easily portable. They may be had in both reciprocating and rotary pumps. The delivery should be from 40 to 50 gallons per minute.

Asphaltic oils which require slight heating for application and the light refined tars can usually be liquefied sufficiently to work well with the ordinary pumps. They can also be handled with some form of ejector apparatus operated with steam, such as the Kent unloader. Since steam is driven directly into the material, an ejector is not available with the heavier asphalts, which require further heating over a direct fire. The water in this case would cause foaming.

TAR CAR WITH STEAM FITTINGS *to blow refined tar binder from car to tank wagon by steam pressure. Note fittings on top of dome. Steam taken from stationary steam plant on left. Watseka, Illinois.*



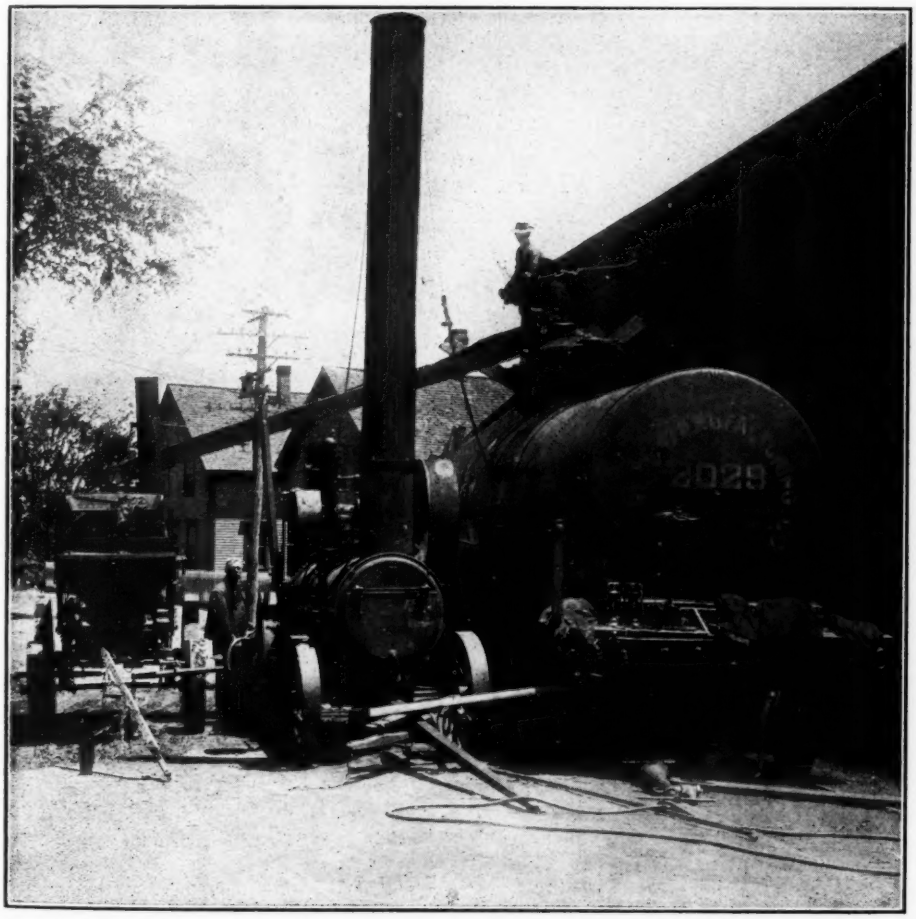
GASOLINE-DRIVEN KINNEY ROTARY PUMP *outfit unloading seventy gallons of Tarvia B per minute at Hull, Mass.*

Heavy tars used for binder purposes and heavy asphaltic oils require special precautions in providing means for heating all parts of the unloading pipes and pumps and for blowing them free of binder after a tank wagon is filled. The simplest method is to introduce a live-steam inlet into the unloading pipe directly beneath the shut-off cock on the tank car. The pipe and pump can then be blown free by steam at any time or a cap can be screwed onto the delivery pipe and live steam blown back into the tank car. The small amount of steam used in this way has no deleterious effect on the bituminous material.

Heavy tar binders may also be unloaded by introducing direct steam pressure on top of the tar in the tank car. The small amount of water introduced remains on top of the tar and does no harm. The method is not available with asphalts, since the water introduced produces violent foaming when the asphalt is subsequently heated.

In arranging the piping for blowing, a steam connection is made thru a hole drilled for the purpose thru the cover of the dome of the tank car. A valve and a steam gage are provided to regulate the pressure. No more than 7 or 8 pounds should be used, and this will be ample if the binder is sufficiently liquid. The tank

REFINED TAR BINDER UNLOADED *by Edson diaphragm pump, taking from dome and discharging into lined wooden trough. Lawrence, Mass.*



cars are not designed to carry more than this pressure. This method is very neat and effective with heavy tar binders and requires no expensive apparatus.

TANK CAR SET ON TRESTLE, *with heating boiler on ground below. Refined tar binder flows by gravity into tank wagon. Laconia, N. H.*

PITTSBURGH'S NEW POLICE SCHOOL

By Hartley M. Phelps, Pittsburgh, Pa.

Most of the complaints of poor service by individual policemen and by police systems arise from the control of the system from outside and the lack of experience and adequate instruction of patrolmen. The former demands removal of control from politics and placing of appointments on a merit basis, and both new appointees and those already in the service can have their efficiency increased by means of the instruction herein provided for. Pittsburg is not alone in the establishment of means of instruction, but seems to have a particularly effective plan.

PITTSBURGH has established a training school for its police, opening about October 1, under the direction and tutorship of Capt. John A. Ford, a Pittsburgh police officer, who has seen service in the United States army. There will be about 900 pupils—that is, the total force of policemen in the city. The school will be not only for patrolmen, but for sub-policemen as well, and is to give courses for the ordinary officers, traffic men and the mounted police, all of which are represented on the force. According to the plans this school bids fair to be one of the most complete and thoro in the United States, and will rank with the best schools of a similar kind established in other cities thruout the country.

The decision to found it is the result of the systematic work of the city council to reform and reorganize the police bureau of Pittsburgh. With this end in view, the Emerson Company, of New York City, was engaged to make a thoro investigation of the bureau, and recommend, as experts, what should be done to place it on a strictly modern basis after the most approved pattern. In its report, submitted to council last fall, it charged, among other things, that one of the chief defects was a lack of discipline. Entanglement in politics and protection of offenders against the law were also set forth. Persons with political power were often instrumental in effecting appointments to the police force, it said.

Much of the inefficiency of the bureau, it further stated, was due to the absence of any method of scientifically training the policemen. Another radical defect was the lack of centralization of control in the office of the director of public safety, under whose jurisdiction the bureau falls. It was also pointed out that lack of records as to crime, and number of arrests, and information as to whether the detectives were performing their duties intelligently, made it impossible for the director to maintain adequate control over the bureau. The activities of the detective bureau were severely scored on the ground of inefficiency.

Concluding this phase of its report the Emerson company said: "The success or failure of police management depends almost wholly upon the department head being honestly advised, thru reports, of the bureau's activities."

Among the important things that will be taught in the classes are to impress on the recruits and on those already on the payroll the fact that they are employed and paid by the people of Pittsburgh; and that they are the people's servants. They must never, under any circumstances, be discourteous to any man, woman or child, or to their superiors, or

even to those under arrest or detention. They are to be especially courteous to people who ask for information, because frequently the first impressions strangers get of a city are from the police. Profane language may not be used at any time; but the officer must conduct himself with dignity and try to win the respect of all with whom he comes in contact; and especially the esteem of the people living along his beat.

Instruction is to be given as regards arrests. Force is not to be used to effect an arrest unless there is resistance, and the use of force must cease as soon as the prisoner is overcome. Firearms may be used only in the pursuit of felons; but they must not be used if innocent persons are endangered thereby, or the felon can be captured without their use. Of course an officer may use his firearms in self-defense, or in defense of a prisoner he has in his custody. The same is true of any citizen or brother officer upon whom a dangerous assault has been made in his presence. An officer must not, however, shoot at a person running away and who has only committed a misdemeanor or trivial offense.

Of course, officers must be reasonably familiar with city ordinances that it is their duty to enforce; so it follows that an important part of the course is the study of such ordinances. Court decisions bearing on the same will receive attention.

PAVING AND BRIDGE TOLLS IN BAVARIA

Practically all Bavarian cities collect a paving and bridge toll, and every road leading into almost every city has a tollhouse somewhere near where it crosses the city line, where automobiles, wagons, carriages, saddle horses, etc., and in some instances motorcycles and even bicycles must stop until the amount of toll (fixed by city ordinance for the particular municipality) is paid.

In Nuremberg all pleasure vehicles owned outside the city may pass in and out freely and without toll, but the pleasure vehicles owned at home are required to pay an annual lump toll. All freight vehicles and draft animals owned outside the city must still stop at the tollhouses and pay.

The collections for bridge and paving tolls in Nuremberg for a year amount to about $46,000. The dividing line between heavy and light is 1,500 kilos (3,307 pounds). The trip toll rates are as follows: For every draft animal in heavy vehicle, 40 pfennigs (9.52 cents); for every draft animal in light vehicle, 20 pfennigs (4.76 cents); for every other draft animal, 15 pfennigs (3.57 cents). Freight automobiles and pleasure cars owned in the pity pay the rates for two-horse teams, light or heavy, according to weight.

For the collection of these tolls the municipality maintains a central office in the city and 22 toll stations on roads leading into the city. Toll stations also collect the octroi taxes on beer and malt and issue certificates to parties bringing live stock or meat into the city. These latter certificates must be presented at the municipal slaughterhouse and constitute a check guaranteeing the due inspection of all live stock or meat brought into the city. Several large breweries are located in near-by towns, and the beer tax reaches a considerable total—about $120,000 annually.

Only the collection of the beer and malt octroi makes the maintenance of the Nuremberg tollhouses profitable, for the amount of paving and bridge toll they take in is trifling. In the smaller towns, especially those lying upon main traveled roads, the paving and bridge toll realizes handsome sums for the municipalities, and while the tollhouse is anathema in the eyes of the auto tourist, it nevertheless serves as well the good purpose of preventing reckless and dangerous speeding thru the often crooked and narrow streets of an ancient and picturesque city.

PORTABLE ASPHALT PLANT

RESURFACING MACADAM ROADS IN CHICAGO.

By Walter G. Leininger, Superintendent of Streets.

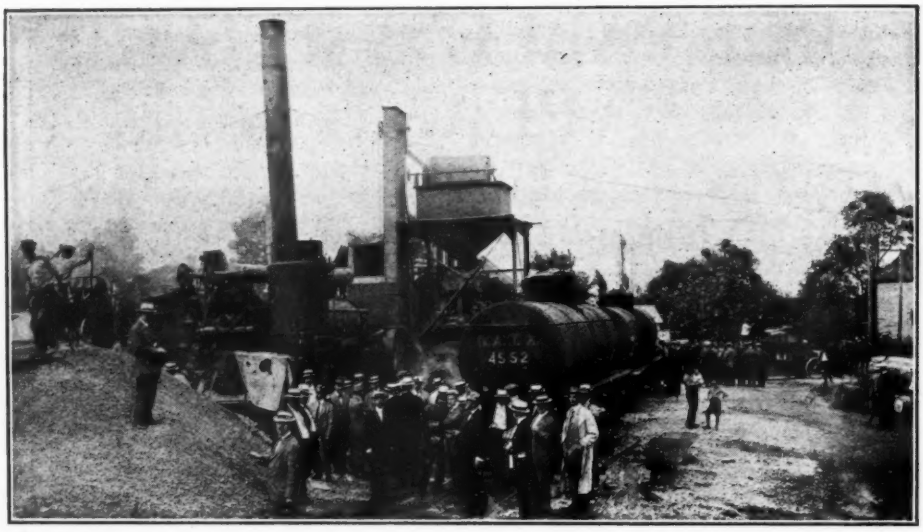
The author supplements his paper on the asphalt paving plant of Chicago, published last month, by this description of the city's portable plant for surfacing outlying streets requiring protection at reasonable prices from constantly increasing volume and weight of traffic. It can be applied to still less expensive work on main country roads if desired.

THRU the efforts of Mayor Harrison, the Highways Improvement Association and the Association of Commerce co-operating, in 1913 an appropriation for street repair equipment was secured and machinery installed that marked the inauguration of increased efficiency in street repairs chargeable to the wheel tax.

At the close of the year the bureau had complied with the earnest demands of the outlying districts and suburbs by completing a series of connecting links from these localities to the city's paved streets. Previous to this time some of these districts were entirely shut off for a considerable time on account of impassable roads. These roads were naturally constructed of water-bound macadam and oiled.

Naturally, macadam seems to be the answer when the first improvement is considered, and altho very little can be said in favor of it when subjected to heavy traffic, it is the foundation for the future good road. The price is the first consideration, but the maintenance has cut such a noticeable figure that further consideration must be given the subject. When the maintenance runs up to 20 cents per square yard, it is appalling to think that in five years the original cost of the pavement has been duplicated. When ditching, grading, laying and properly constructing the shoulder is completed, a dollar a square yard is cheap, and yet the Bureau

UNLOADING STONE *at the rate of one car an hour for resurfacing roads with macadam before placing two-inch top of asphaltic macadam.*

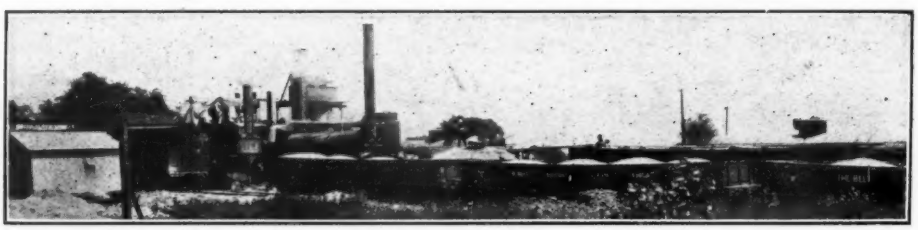


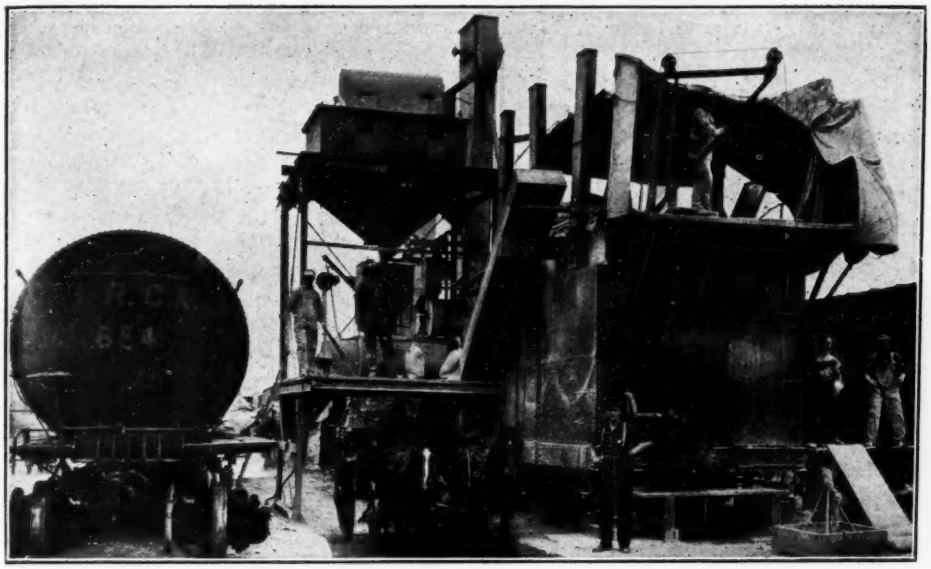
TWO VIEWS *of Chicago's portable asphalt paving plant. Note portable office at left of lower picture. Note method of unloading stone from cars by means of wheelbarrows on running boards from tops of flat cars to top of pile, seen in lower picture and in part in the upper picture. Photographs taken on the inspection trip referred to.*

of Streets constructed 83,000 square yards at a cost of 56 cents per square yard.

"Why does this pavement fail?" has been asked many times, and the answer has always been low, wet land, and the tendency for traffic to keep in the same rut on an 18-foot road. To eliminate this it was decided to cut down the crown and resurface these roads as fast as possible with a 2-inch top of asphaltic concrete. The present asphalt plant was located to take care of asphalt repairs on the city's streets out of reserve; hence the necessity for a portable plant was imperative. Such an equipment, in the shape of a one-car portable plant, equipped to burn coal or oil, was purchased from Warren Bros. at a cost of $13,000.00. This plant can be moved about at the outskirts of the city, and the resurfacing of old macadam country roads has now begun in earnest. The plant has been turning out 2,500 square yards of 2-inch top per day, or 1,000 linear feet of 18-foot roadway is being done in nine hours. The bureau is completing a mile each week, and the cost per square yard is approximately 70 cents. This includes all cost of preparing the old road and laying the 2-inch top.

Such an improvement will last five years without repair, and the maintenance will then be slight in comparison to the old water-bound macadam. It is desirable to have at least ten inches of stone at the center and from four to six inches at the edges, hence, in some cases three to four inches of new material is laid on the road before resurfacing. The surface is made as flat as possible, and, since Chicago is naturally flat, there are no noticeable grades. The old macadam roads were





ANOTHER VIEW *of the portable asphalt plant, showing mounting on car and the mixing platform in place for operation; also unloading of materials from tank and box cars on either side and the crane elevator for raising materials to top of plant.*

constructed with as little grading to profile as could be accomplished, hence the finished resurfacing is practically at the same profile. An absolute profile would necessarily be followed in a rough and uneven locality, which would increase the cost considerably.

When it is considered that the department has repaired 300 miles of macadam pavement this year and resurfaced five miles of it with asphaltic concrete, the great amount of work ahead seems appalling. The success of this improvement is hinged entirely upon the wheel-tax collections, which up to date represent $650,000.00. Out of this the department has spent for all repairs $450,000.00.

The present plant can resurface thirty miles in a season without trouble, and, with the proper funds and equipment the 500 miles of macadam streets in Chicago would soon be made permanent pavements. An earnest endeavor along this line should be followed, for then the cost per linear foot to the property would not exceed $1.25 on each side of the street. When this price is compared with the assessment usual for a permanent pavement the resurfacing plan should be met with approval by the property owners and parties interested in good roads.

Every interest is directed to the proper and scientific methods of doing this work and in obtaining the best results.

The mix so far will average approximately 6.5 per cent. bitumen, 37.2 per cent. sand, 52.3 per cent. stone and 4 per cent. filler. The aggregate being used is crushed granite ranging from ¼-inch to 1-inch in diameter, with torpedo sand and Universal Portland cement. The price of granite this year is $2.25 per cubic yard.

The plant is located on a center track, with two switch tracks, one on each side thereof, and 16 feet distant. Material is placed on these tracks and unloaded directly in front of the different conveyors. The sand and stone are mixed in proper proportions and run into the dryer, where the mixture is heated to 300 degrees F. From there it is conveyed to the storage bins and thence to the measuring bins, where it is drawn off to the 15-cubic-feet mixer as required.

To facilitate the quick delivery of material on track, the bureau has a car tracer, who covers the territory on a

motorcycle and keeps the cars in transit. This man covers a distance of 75 miles each day.

The work of preparing the old macadam road differs somewhat in different localities. Where the existing surface is in good condition and has a suitable line grade and contour, the surface is swept thoroly to remove all the loose particles and expose the rough stone. If any depressions exist they are filled with binder and tamped. In this way the existing road is made parallel to and two inches below the finished surface. Along the edges of the road care is taken to provide a good shoulder to hold the pavement in place. Where the soil is soft, stone is added and the shoulder thoroly rolled.

Where the old macadam is flat or depressed at the center, the sides are picked up and the material moved to the center. Care is taken not to lower the sides so that less than four inches of stone exists in a firm condition.

Where the condition is such that additional material is required, the street is scarified to a depth of three inches and material added, making the center at least ten inches in depth and the sides six inches. About 2½ inches is found sufficient for drainage from the crown to the edge. At the present time the plant is running at capacity, and the force at the plant and on the street consists of:

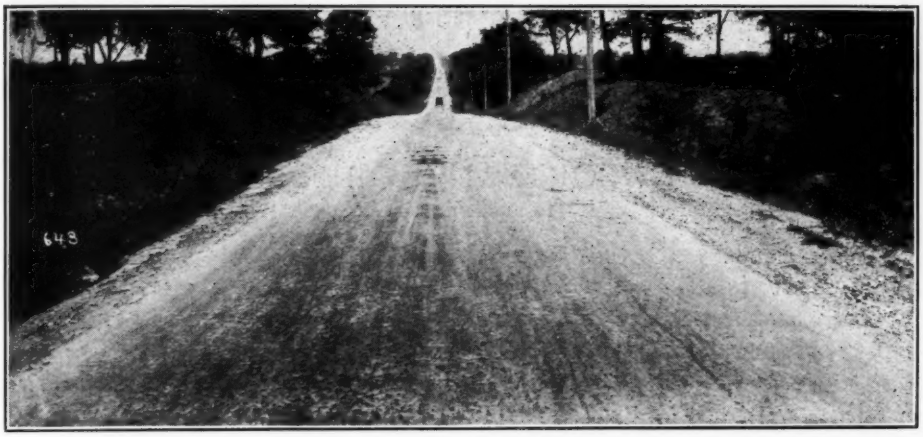
Plant—1 foreman asphalt plant, 1 chief drum man, 1 drum man, 1 kettle man, 1 mixer man, 2 time keepers and material men, 25 laborers, 18 teams, 1 assistant chemist and 2 watchmen.

Field—1 asphalt foreman, 2 rakers, 2 smoothers, 2 tampers, 15 helpers, 2 watchmen and 2 roller engineers.

In order to hold the present macadam streets in place until they can be resurfaced at some future time, the bureau has used 1,720,000 gallons of heavy road oil. This oil helps to bind the macadam and stops the dust nuisance. Road oil was purchased this year for approximately 3.64 cents per gallon.

On July 30, the Bureau of Streets, in conjunction with the Association of Good Roads, took interested citizens, contractors, automobile manufacturers and city officials through the shops and plants of the bureau and over the streets and roads being repaired by the department.

LAYING TWO-INCH ASPHALT TOP *on macadam base on Western avenue, Chicago.*



THE COMPLETED ASPHALT TOP *on macadam base on Western avenue, Chicago.*

This was the first trip of the kind that any of these men had taken, and the result was encouraging, for it has developed a sentiment and interest in the bureau's endeavors that could not be gained in any other way. It demonstrated that the wheel tax fund was being spent judiciously and that the work was being pursued in a scientific and efficient manner; it also created an interest in the collection of more wheel tax money and the necessity of additional appropriations to help out along the lines of a great improvement. This year's work has completed all but half a mile of a thru route from Chicago to the Lincoln highway, which, with the interest now at its height, may be improved before the close of the season.

WHERE EXPORTS FROM THE UNITED STATES GO

The world's leading importers are the United Kingdom, Germany and the United States, in the order named, France being fourth and the Netherlands fifth. The United States and the United Kingdom are the world's largest exporters, followed by Germany, France and the Netherlands. The United States furnishes about 20 per cent. of the total imports into the United Kingdom, 15 per cent. of those into Germany, 10 per cent. into France, 14 per cent. into Italy, 65 per cent. into Canada, 53 per cent. into Cuba, 50 per cent. into Mexico, 15 per cent. into Argentina and 15 per cent. into Brazil. The Commercial Relations of the United States, a volume of 272 pages, just issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, contains revised figures showing in detail for the year 1912 compared with the previous year the articles entering into the trade of each country and the commercial transactions with the United States. This volume should prove valuable to those interested in the foreign trade of the United States and foreign countries. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 40 cents each.

FINANCING PUBLIC IMPROVEMENTS

IN PORTLAND, OREGON.

The success of the Oregon method of raising money for public improvements at low rates of interest and small cost to the contractor, and therefore to those who pay for the improvements, warrants this description of the plan and details, from data furnished by one thoroly familiar with all steps of the process. It will be noted that it is largely in details that the method excels and that the reduction in cost of financing is made. Note particularly that the small denominations of the bonds and their ready transfer, almost as easily as cash, makes them a popular investment for men on salary or wages with a little surplus.

THE provisions of the charter of the city of Portland, Oregon, concerning the financing of municipal improvements have had so favorable an effect upon the popularity and price of bonds sold to raise the money to pay for the improvements that the plan is well worth the study of municipal officials in other cities and of state legislatures.

The principal features of the charter provisions are as follows:

The owner of any property assessed for street improvement or sewer, at any time within thirty days after notice of such assessment is first published, may file with the city auditor an application to pay in ten annual installments, with interest at the bond rate provided, waiving all irregularities and defects in the improvement and assessment proceedings.

When the docket showing all liens thus assumed is made up as provided, the city authorizes the issue of its bonds in convenient denominations, not exceeding $1,000 each, and in all equal to the total amount of the unpaid assessments for such street improvements and sewers, maturing in ten years, with interest not to exceed 6 per cent. per annum, payable semi-annually. The city reserves the right to take up such bonds upon payment of the principal, with interest, at any semi-annual coupon period, redeeming them consecutively by number, on notice published not less than twice during the preceding month.

Thereafter the owner of each lot who has thus deferred payment of his assessment must pay each year 10 per cent. of the assessment, with one year's interest at not to exceed 6 per cent. per annum on unpaid assessments or installments. Should he neglect or refuse to pay such sum when due and payable, for a period of ninety days, then the whole amount of installments remaining unpaid becomes due and payable and shall be collected in the same manner and with the same penalties as delinquent street or sewer assessments are collected.

The owner of any property having such lien on it may at any time pay into the city treasury the whole amount of such assessment for which such lien is docketed, together with the full amount of interest and costs accrued thereon to the date of payment.

At any time after the bonds become payable the city may redeem them consecutively by number, on notice by publication in the city official newspaper once each week for three consecutive weeks, giving therein the numbers of the bonds which will be redeemed and the time at which such redemption will be made, and after such time so fixed for redemption

no interest accrues or becomes payable on such bonds so notified for redemption.

The contractor, on the completion of his street or sewer improvement, is paid by the city in general warrants, same bearing 6 per cent. interest ten days after the acceptance of the work. In the meantime the property owner is allowed to pay cash or bond the improvement, as he may see fit, and as fast as the cash is paid into the city by the property owners the contractor is notified and he cashes his warrants up to the amount of money they have on hand in this particular fund. After the ten days have expired to either bond or pay cash for the improvement, if the property owner does not take the benefit of either one, he is notified by the city that they will commence foreclosure of the lien unless the property owner pays his assessment, plus the accrued interest up to the time of payment.

About every three months the city calls for sale of bonds covering all the bonded obligations that they may have on hand, and as soon as the sale has been made by the city and cash received, the city notifies the holder of the warrant that they have sufficient funds on hand to take care of outstanding warrants and the interest will cease on or after a certain date.

The city, in selling their 6 per cent. bonds, have been able to obtain a premium up to as high as 5 per cent., altho the bonds are payable on or before ten years at any interest period paying time after the first year, and the life of city bonds has run on an average of five years. This class of investment has proven very attractive to the local banks and they handle all the paper that the city can issue. At least they have done so up to this time.

This method of financing the local improvement work is very satisfactory to the local banks, as they are willing to assist any responsible and reliable contractor, as they understand that they will receive all of their money loaned to the contract within ninety days after the acceptance of the work.

Frank S. Grant, formerly city attorney of Portland, states that during his years of service as city attorney he does not recall a single instance where the bonds failed to bring from a 1 per cent. to a 3 per cent. premium.

The provisions respecting deposit of money in banks are, briefly, as follows:

Any bank in the city with a paid-up capital of $50,000 may apply for a deposit of a portion of the city funds. The council shall determine which bank or banks shall receive the city funds and shall be designated as depositaries of the city funds. As security for these deposits the banks are required to deposit with the treasurer either bonds of the city of Portland, port of Portland or school district No. 1, or well-recognized railroad, street railway, city, county or municipality bonds, the interest upon which has not been in default for a period of six years and the market value of which is such that the net return of the bonds is no greater than 5 per cent. per annum. The face value of these bonds, at all times, must equal the amount of money on deposit by the city.

Banks that offer bonds of the city of Portland, port of Portland or school district No. 1 as security are given preference. Where the banks simply offer state, county, municipality, school or railroad bonds, and do not offer city of Portland, port of Portland or school district No. 1 bonds, the requirement is that the market value shall at all times be kept not less than one and one-fourth times the amount of the deposit. These funds are subject to the order of the city treasurer at all times.

All these provisions make a demand for improvement bonds which has never been fully satisfied, and they prevent sales of bonds at discount or excessive commissions on loans to contractors, so that the contract prices for public improvements are not loaded up with such discounts, as in some other states. Taxpayers, contractors, bankers, purchasers of bonds, are therefore satisfied, one by ease of payment at the same time that the cost of the improvement is not increased by the accommodation (beyond the interest), and the others by the safety of the investment and the satisfactory returns from it.

STOCKYARD REFUSE

REMOVED BY MOTOR

This very interesting solution of a special problem in refuse removal will be of interest also because of the possibilities of modifying the methods for application to such problems as garbage and refuse collection and removal, especially in the more congested districts of a city, and to the delivery and removal of materials in a plant where they must be distributed over or collected from considerable areas.

THANKS to the efforts of our trade periodicals, the horse-using public are at last awakening to the true understanding of the difficulties of economical hauling, and a few more are reorganizing their entire systems to conform to the requirements of the new money-making, labor-saving wonder, the motor truck. All are thinking, and, of course, will eventually adopt the mechanical power.

Realizing that the motor truck or tractor is but a part of the equipment required to solve the problem of transportation of material, and that in simply substituting the motor truck for the horse a comparatively small gain is accomplished, the Mercury Manufacturing Company has entered the field of special haulage and handling machinery. With competent forces of engineers, backed by well-equipped machine shops, they not only manufacture and sell tractors and trucks, but can also design, build and install complete systems of conveyors, elevators, tractors and trailers, exactly fitted to handle material in the most economical manner.

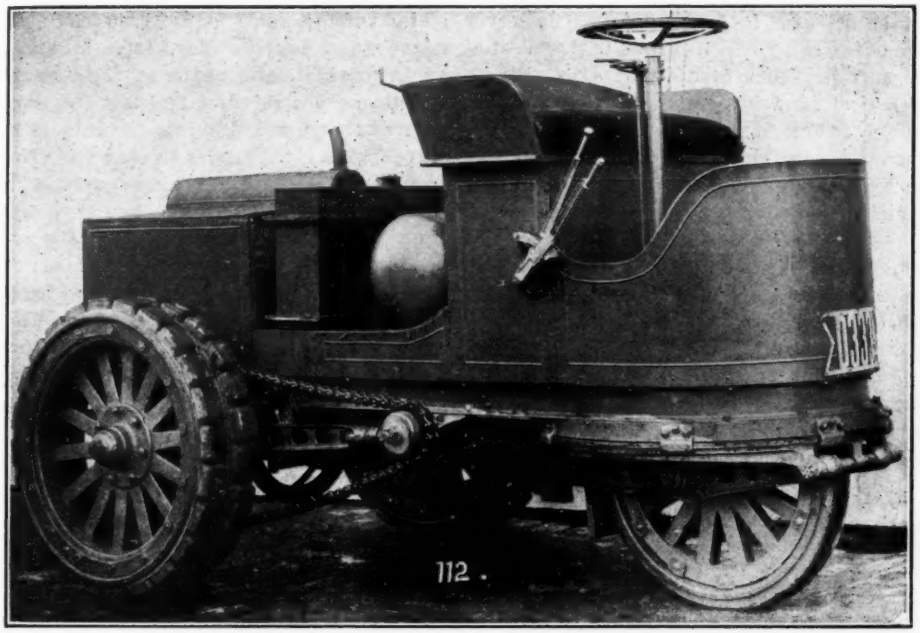
As an example of a more or less complicated case which is being handled, we will describe briefly the manure disposal and cleaning system recently installed in the Union Stock Yards of Chicago.

Up to the present time the work has been done with four-wheeled dump carts, requiring forty teams of horses, valued approximately at $24,000. The carts were loaded in the pens and hauled to a dump at the south end of the yards. The dump was in the form of an elevated platform, made necessary because of the fact that the carts must be elevated and dumped into a freight car, and the incline leading to the dump was steep on account of the small space available.

The average haul is one-half mile, and, of course, the horses were idle during the loading and dumping process, also all day Sunday, Monday and Wednesday, or three-sevenths of the time. With the present system installed, horses are eliminated and replaced by tractors, trailers, snowplows, sweepers and power dumping apparatus. A description of these elements will pe interesting to our readers, and also photographs of some of them.

In the particular installation which we will describe the Bulley tractor is employed. This tractor presents many new and interesting features, and is particularly adapted to this work on account of its compactness and extremely short turning radius, made possible by the three-wheel type, and the fact that the engine is situated over the rear axle, which also aids in giving the remarkable draw pull of nearly one and one-half tons, or over one-half the weight of the completed machine.

The power is derived from a four-cylinder heavy duty motor, which, as stated above, is situated over the rear axle, and between the wheels. On account of the complication of the ordinary type of starter, and because a crank could not be used if situated in the usual position (in this case behind the tractor) because of the train attached to the rear, a modern



THREE-WHEELED BULLEY TRACTOR *used in hauling refuse carts about the alleys in the Chicago stockyards.*

cranker was decided upon, and the starting lever is placed by the driver's seat. This method has proven most satisfactory.

The clutch, of the dry plate type, is placed ahead of the motor and between it and a Cotta transmission, the gears of which are always in mesh, and which is in unit with the differential gears and rear wheels by means of very heavy Diamond chains on hardened sprockets.

The rear wheels are of hickory, and carry 39 by 4 block tires. In slippery road conditions a special non-skid device is placed over the tires, and it has demonstrated that the tractive effort is not lost nor greatly reduced even in the heaviest snow of this locality, when the tractor is used to drag a 12-foot snowplow to clear the way for the trains so that service is uninterrupted.

The front wheel is mounted on an axle to which it is fastened so that the axle revolves with the wheel, and between two heavy cast steel beams, in each of which is a stationary hub holding the ball bearings on which the axle revolves. These beams are fastened together rigidly at the rear, but are mounted on bearings at the front. The rear is held between springs, allowing of vertical motion of the rear end and the wheel.

The bearings work between plates, preventing lateral motion. The bearings at the front, and springs and plates, are connected to a ball-bearing cone, which is larger in diameter than the wheel, so that the center of the wheel is very near in line with the ninety-eight ¾-inch balls upon which the cone works, the balls being held by a stationary cup fastened to the frame of the vehicle.

A dust-washer is provided, also means preventing the cup and cone from separating. To the right of the wheel and fastened rigidly to the cone is a segment of a gear which, working with an adjustable pinion at the end of the steering column, allows of turning cone, beams and wheel.

It is noticeable that it requires less effort to steer this tractor than the ordinary pleasure car.

Two sets of brakes are provided. The emergency brake acts on two drums, one on each jackshaft, by means of a hand lever at the right of the driver's seat. This brake may be set and the service

brake actuated by a foot pedal. The service brake is applied from the foot pedal to a shaft just back of the rear axle with a quick adjustment at the point of attachment. At each end of the shaft is attached a cam, expanding the brake bands in the usual manner. The drums are sixteen inches in diameter, and the bands three inches wide, giving an effective brake area of about 280 square inches.

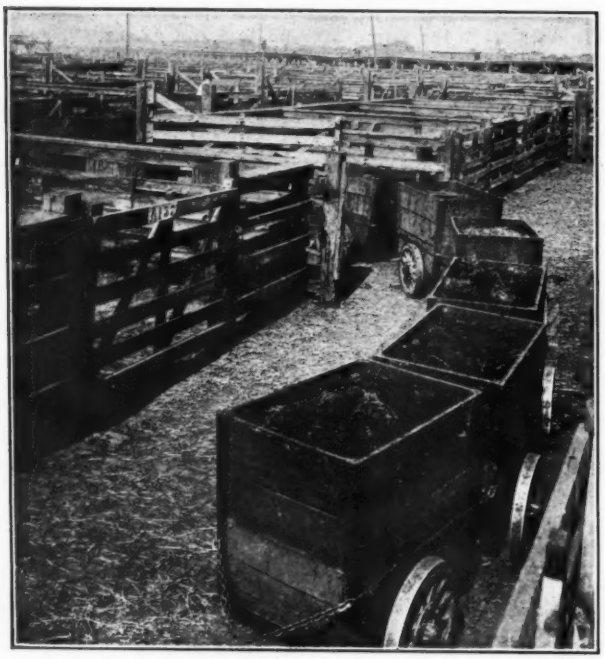
The Bulley tractor may be had in either electric or gasoline type, and with four wheels instead of three to meet the various requirements of road conditions, turning radius, fire risks, etc., so that the general outline remains the same. The machine is universal as manufactured—that is, within its capacity and working field.

The trailers of this installation are also of the three-wheel type, and weigh when loaded one ton each. When hitched up in trains of twelve they track perfectly, as will be seen from the cut. It is possible, and, in fact, is daily practice, to negotiate a 12-foot alley, turn at right angle to right, and again at right angle to left, so that the first and last few cars are running parallel, while the middle is traveling at right angles to each end. The train may be completely turned around in a 16-foot alley, so that the last cars are running past the tractor going in the opposite direction. The two main wheels of these trailers are of wood with steel band mounted on Hyatt roller bearings. The third wheel is of iron, of the caster type, also mounted on roller bearings, the Bower being used, and pivoted on a cup-and-cone ball-bearing of special design. It was necessary to go into this refinement so that the trailers may be pushed easily by hand when being coupled up into trains, or put into the elevator described later. Chains are provided at the front and rear of each trailer. These chains are fastened at the corners of the cart, and have a combined hook and ring at the intersection of each pair. There is no iron or fastening of any description on the trailers, to accommodate the elevator.

A cut of the special electric dumping elevator is shown in the picture taken with a trailer in the act of being dumped. The elevator receives a trailer, lifts, dumps and delivers it on the train platform automatically. It is driven by its own power in both directions along the track, so that a number of freight cars may be loaded by the same elevator without having to move the cars.

Probably the most interesting unit of this installation is the dumping elevator, three of which will be used in the complete equipment. The elevator consists of a structural steel tower, mounted on flanged wheels, and is self-propelling along the rails parallel to the train of freight cars to be loaded. The machine is electrically driven, power being

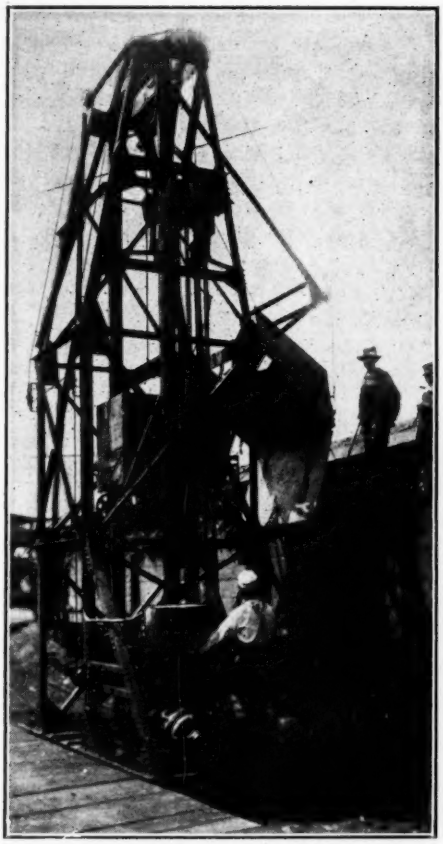
REFUSE CARS *in alleys of Chicago stockyards, showing how they follow in train thru the narrow right-angled alleys. Middle section of train is traveling at right angles to the two end sections.*



taken from three overhead wires by means of trolley poles (not shown) and led to the controller-box at the left of the operator thru a metal conduit.

The motor, shown at the left of the operator, is of the induction type, and develops ten horse-power at 900 r.p.m., driving by worm and gear a shaft extending across the frame. A chain from this shaft drives the elevator in either direction according to the position of the switch above the operator's left hand and the clutch, the lever of which is at the right. The operator is standing with his left foot on the quick-acting brake, which will stop the apparatus almost instantly. On the same shaft on which is mounted the clutch, etc., for driving the machine on the rails, are keyed two pinion gears engaging with two larger gears, one of which drives each of the parallel vertical chains, to which a wire rope leading to the cage is fastened. These chains always move together, the object being to give a positive and limited motion to the cage, and also to retard its motion at the top and bottom. The upper chain sprockets are adjustable to compensate for stretch in chain, and for adjustment of cage's vertical movement, which, of course, corresponds exactly with the distance from the top of the upper sprockets to the bottom of the lower sprockets, in this case fourteen feet six inches. The cage is adjusted for position by a twin buckle between the wire rope and the bridle connecting it to the chains.

The cage is a framework of steel having three tracks to accommodate the wheels of the trailers, working against wheels fastened to it, and rolling in two vertical channels. The trailers are pushed into position on the cage, and, striking against spring bumpers at the rear, are adjusted to position by a slight depression in the middle rail and the front wheel. The motor is started and the cage gathers velocity as the wire-rope fastening changes from a horizontal to a vertical motion in going around the upper sprockets the first quarter of a revolution of these sprockets, when it has reached the maximum speed of sixty feet a minute. This allows of dumping from sixty to seventy trailers per hour, depending upon the condition of the material to be dumped, some freeing itself more readily from the carts than others. The cage continues its upward motion at a uniform speed, and as the upper end of the trailer reaches a point opposite the apron on which the load is dumped, it is engaged by a balanced pivot angle, so the motion of this end of the trailer is arrested, with the result that the two main wheels roll toward the front, and the front end of the trailer is raised. As the rear end is stationary, the cart is partially inverted and held in that position as the bridle passes over the lower sprockets. The time of dumping is adjusted by the size of these sprockets. As the motion of the cage is



UNLOADING ELEVATOR, *running on track parallel to railroad cars, lifts refuse cars and dumps them into the flat cars.*

reversed, the trailer is righted and assumes its normal position on the rails. As previously stated, the trailer has no attachments, and is not fastened in the cage, but the active forces are so balanced that the trailer always hugs the angle and remains in the desired position. The two main tracks of the cage are pivoted at the front, and, as the cage rises, two legs drop down. When the cage approaches the bottom, these legs striking elevate the rear end of the tracks so that the trailer is expelled into the platform. As the trailer leaves the cage the wheels strike levers, tripping the rails, so that the cage is ready to receive the next cart.

The tractor leaves the dump with a train of from eight to twelve empty trailers, distributes them and returns with an equal number of loaded carts.

It will be noted that it is always possible to have plenty of work ahead of the shovel men, which was not formerly the case, and that the trailers are so much lower than the old dump carts that they are loaded with much less exertion on the part of the men.

It has been demonstrated by a side-to-side run, without the knowledge of the workmen, that a single tractor with twenty-four men, including the driver, helper, elevator operators, etc., will do the work of twenty-two teams of horses and thirty-five drivers, dump and shovel men.

The equipment was invented by G. W. Bulley, president of the Mercury Mfg. Co., and is completely covered by patents issued, allowed or pending.

In a later issue we will describe a new method of freight handling, some of the units of which are already delivered, and which is as novel as the above descriped system.

NEW YORK MUST GO ON CASH BASIS

New York City needs $100,000,000 to pay obligations, four-fifths of which are payable in gold to foreigners. To raise this money it has been necessary to go to the bankers, and a syndicate was formed to raise the money. The city's necessities in securing the refunding of these obligations have given the bankers an opportunity to perform a public service by requiring the city to retrench sufficiently to pay off these refunding bonds in fifteen annual instalments out of the general taxes, so that they will not come up again for refunding.

Moreover, they demanded that many public improvements for which contracts had been let should also be paid for within fifteen years and the money raised by taxes in annual instalments, and, after some modification of their original requirements, the bankers, the citizens interested and the city officials agreed that improvements authorized by the city during 1915 which are not self-sustaining should be paid for 25 per cent. from taxes and 75 per cent. by the issue of one to fifteen year corporation stock. Improvements authorized during 1916 should be paid for 50 per cent. from the tax budget of the next year and 50 per cent. by sale of serial stock; during 1917 they should be met 75 per cent. from the budget and 25 per cent. by serial stock, and in 1918 the full cost of such improvements should be met from taxes.

The bankers announced that the securities were to run one, two and three years. It was believed the high rate of interest would induce many of the foreign holders of the old securities to accept the new ones in exchange, so that little gold will go abroad.

CONTROVERSY OVER ELECTRIC RATES

IN HOUSTON, TEXAS

By Paul H. Sheldon, Houston, Texas.

The same questions have arisen in Houston as in other cities attempting to revise public service rates. The differences in opinion are liable to arise in other cases, as in this, from lack of information and unwillingness to impart information, on one side or the other. If the city will follow the advice of its experts and the company will open its books to them, there need be no such calamity as the establishment of a competing plant, whether private or municipal, and both sides should receive justice and satisfaction.

IN an effort to bring about a substantial reduction in the lighting and power rates in Houston, the municipal government conducted a far-reaching investigation into the cost of producing electric light in various plants all over the country.

The Houston Lighting and Power Company rates for years have been as follows:

Motor supply, 6 cents per kw. hour for primary service and 5 cents for secondary service.

For general commercial service, 12 cents for primary service and 7 cents for secondary service.

For arc lamps, $70 each per year.

Mayor Ben Campbell and the city council employed Lamar Lyndon, consulting engineer of national prominence, and Henry T. Elrod, consulting engineer of Dallas and Houston, Texas, to make thoro investigation of the Houston Lighting and Power Company. After four months' work they reported that the light company from January 1, 1902, to January 1, 1914, had earned $2,688,543 net, or approximately 18 per cent. per annum. Based upon this report, it is the contention of the city of Houston that the light and power rates should be reduced approximately 40 per cent. The experts' report shows that this may be done without lessening the efficiency of the service and still allow the company to pay a profit of 8 per cent. per annum on its investment.

Attorneys for the light company asked 90 days to prepare data in substantiation of their holding out against the reduction. They agreed to date any reduction decided upon later, from April 1, 1914, but notified the city that they would not submit to an arbitrary reduction.

In support of a 40 per cent. reduction the Lyndon-Elrod report states that the city of Houston could erect its own lighting plant, pay the cost of operating it, furnish electrical energy for the use of all city lights as well as for commercial purposes, at rates approximately 40 per cent. less than now charged by the company, and still pay for the plant in five years.

The summary of the Lyndon-Elrod report indicates the original cost of the corporation's lighting plant, the amount that has been spent in improvements, the present value of the plant, rates charged for various forms of service and rates that could be charged on the basis of 8 per cent. per annum returns. The report also indicates what it will cost the city of Houston to construct a municipal lighting plant, equipped with every modern apparatus and new machinery.

The total cost of the properties is shown

in the accompanying table, together with depreciation and appreciation values and resulting present value. The report stated that at various periods the company started depreciation funds, but they were subsequently converted into dividends.

Officers of the company admit that the corporation has made big dividends, but they say it was done by good management and not by "hold-up" rates. Answering the city, the officials state that they are willing to make a substantial reduction in lighting rates to prevent the city from undertaking the construction of a municipal lighting plant, but that 40 per cent. general reduction is too great a sweep at one stroke.

¶ ADVANTAGES OF MUNICIPAL OWNERSHIP *are advanced by the city officials as one argument for lower rates.*

Mayor Campbell states that one of the principal evils in the light matter which the city seeks to remove is the alleged practice of the company charging the primary rate from a number of small consumers who are entitled to the secondary rate. The smaller consumers are charged the maximum rates, while the large concerns all enjoy the minimum rate of 5 cents.

The advantage of a municipally owned lighting plant as outlined by the city officials is that the municipal government can get money more easily and at a lower rate of interest than a corporation; that bonds of a municipality are usually sold at a premium, while bonds of a private corporation are sold below par. The annual legal charges in the case of a municipal plant are held to be lower, and a smaller operating organization can be maintained. These facts are being advanced in support of a municipal lighting plant for Houston.

The practice of making different rates for different users of electricity in Houston has been and is being subjected to severe criticism. The present maximum rate for general commercial service is 12 cents per killowatt hour primary service. For secondary service it is 7 cents. The city charges that the company has quoted a private rate as low as 3 cents. If an agreement is reached, the city will probably require the company to allow no reduced rates to consumers and there will be no further discrimination in any rates.

¶ DIFFERENCES IN RATES *according to differences in service and time of service must be taken into account in fixing a schedule.*

This view is expected to be changed, however, by subsequent events. The Lyndon-Elrod report is authority for the statement that it is impracticable and inequitable to make a fixed rate for electrical service to apply to all users. This may serve to change the attitude of the city at a later date on this question. The experts state that the generating and supplying of electrical energy differ, fundamentally, from that of any other industry by reason of the facts that the total output must be manufactured exactly at the instant of demand; must change instantaneously with change in demand; and the demand for any instant is fixed at the will and pleasure of consumers. Since electricity cannot be commercially stored, the boilers, engines, dynamos, pumps, conducting wires and all parts comprised in equipment and distribution system must have sufficient capacity to produce and distribute an amount of electrical energy which is equal to the greatest possible demand that may be imposed on the system at any one instant.

The income, however, is obtained from the total output of the plant for a given period of time, and therefore depends on the average of the heavy and light loads thruout the year. The report states that a consumer who would use current at periods of the day when the load on the power station is light, should purchase electrical energy much more cheaply than one who uses an equivalent amount, but taken at a period of heavy load. In the first case the only increase in station cost due to supplying the customer during periods of light load is the fuel cost, a fraction of a cent per kilowatt hour. In the second case, the consumer who takes his supply at a period of heavy loads on the station costs not only the additional

fuel consumed to produce his energy, but also the additional size of the equipment, the distributing system and possibly the labor required.

As an instance of how the individual load factor has an important hearing on the cost of supply, the example was given: "Consider the cases of one consumer having a 5-h.p. motor which he uses eighteen hours per day, and another consumer having a 40-h.p. which he uses two hours per day. The first man uses 90-h.p. hr. per day while the second man uses only 80-h.p. hr. per day. But the investment required to provide the equipment and transmission system to distribute the current to the owner of the 40-h.p. motor is eight times as great as the investment to cover the requirements of the owner of the 5-h.p. motor. Obviously, the first named consumer is entitled to a lower rate for his current than the second man. His load factor is 75 per cent., while the load factor of the 40-h.p. motor is only 8 1/3."

The attitude of the city officials is not to act arbitrarily in the matter of effecting a reduction in the Houston light rates, but to so bring about a reduction that the company may still make 8 per cent. profit on their investment, without impairing the efficiency of the service.

Upon the completion of the Lyndon-Elrod investigation, which gave the company a valuation to date of $1,524,841.79 on which it was entitled to earn returns, the Houston Lighting and Power Company asked and was granted until August 1, 1914, within which to file an answer.

On July 24, the company filed this answer to the city of Houston, in which the corporation claimed capital entitled to returns of $2,753,584.63 as based upon estimate of company valuation engineers. This amount was $1,228,742.84 more than the amount allowed by the Lyndon-Elrod valuation. The accompanying comparative statement of the Lyndon-Elrod and the company valuations shows that the city's experts charged $499,232.87 to depreciation, while nothing was charged to depreciation by the company's experts.

Upon the filing of this report the city of Houston immediately notified the company that the reduction of light rates for Houston would be determined finally at a meeting of the city council to be held October 1, 1914, said reduction to date from April 1, 1914, and rebates to be allowed citizens on light bills contracted after April 1, 1914. The matter will then be closed unless the company decides to take the question into the courts.

Messrs. Lyndon and Elrod have drawn up rates for light based upon 6, 7 and 8 per cent. returns on the city's valuation of $1,524,841.79.

The city of Houston is continuing its investigation into the cost of constructing a modern municipal lighting system, and city officials intimate that the failure of the company to agree to a satisfactory reduction may result in the city of Houston installing one of the most modern lighting plants in the South. Public sentiment favors the ownership of all public utilities, which would doubtless facilitate the financing of such a project.

COMPARATIVE STATEMENT OF HOUSTON, TEX., LIGHTING REPORTS.

Item	Company Report	City Report
Direct Construction Costs.		
1. Buildings	$110,852.50	$101,320.00
2. Land	64,364.50	46,005.00
3. Equipment	721,014.00	673,760.56
4. Pole lines and fittings	199,419.45	131,320.62
5. W. P. wire	138,026,70	138,399.64
6. Service drops	58,119.05	44,640.00
7. Transformers	137,538.47	101,898.50
8. Conduits	110,660.58	.....
9. Cable	128,332.96	231,271.37
10. Meters	171,784.90	127,297.90
11. Arc lamps	44,345.95	51,396.00
12. Lamp fixtures	2,453.50	3,500.00
13. Wire and fittings in building	16,954.11	.....

14.	Right of way	4,288.00	.....
15.	Furniture and fixtures	9,691.05	9,691.05
16.	Teams, vehicles and automobiles	15,043.28	13,443.28
	Total direct construction cost	$1,932,889.00	$1,673,943.92
	Indirect Construction Costs.		
17.	Engineering	135,302.23	*.....
18.	Insurance during construction	5,323.80	.....
19.	Taxes during construction	14,936.70	.....
20.	Interest during construction	94,389.32	.....
	Total indirect construction cost	$149,952.05	$103,620.27
	Working Capital.		
21.	Working capital—Supplies	47,846.85	48,331.60
22.	Working capital—Cash	50,000.00	10,000.00
	Total working capital	97,846.85	58,331.60
23.	Work in progress	49,495.73	.....
24.	Total physical property	$2,330,183.63	$1,835,895.79
	Intangible Property.		
25.	Unclassified fixed values	.....	151,705.24
26.	Cost to establish business	423,401.00	.....
	Adjustment.		
27.	Sub-total		$1,987.601.03
28.	Deduct land appreciation		38,305.00
29.	Sub-total		$1,949,296.03
30.	Add discarded equipment		74,778.63
31.	Total from city's report		$2,024,074.66
	Depreciation.		
32.	Deduction		499,232.87
	Capital entitled to returns	$2,753,584.63	$1,524,841.79

*6.18 per cent. for the four items together.

TRACTION ENGINES AND TRAILERS OF WAYNE COUNTY COMMISSIONERS, DETROIT, MICH., WHICH TRAVEL REGULARLY OVER THE CONCRETE ROADS, ESPECIALLY MICHIGAN AVENUE, ON WHICH THE COUNTY PLANT IS LOCATED.

ELECTROLYTIC SEWAGE TREATMENT

IN THE BORO OF QUEENS, NEW YORK CITY.

By Maurice E. Connolly, President of the Boro of Queens.

Reference should be made to the editorial on another page for some suggestions regarding the treatment of this article. The authority of a boro of the city of New York bespeaks careful consideration of the results reported, but the failure to obtain some data which are essential to a complete understanding of the situation will lead the reader to suspend final judgment until fuller information is obtained.

THE question of ultimate sewage disposal is at present acute. For years the method of water-borne disposal has been practiced, until today our harbor is polluted to a dangerous degree. The Hudson River and the contiguous waters of the East River and upper bay are assuming the aspect of a gigantic cesspool because tidal action is inadequate to remove more than part of the refuse, the residue, particularly the sludge, settling until at the mouths of some of the sewers a stratum of twenty or thirty feet has accumulated, and no germicidal action of any consequence takes place.

In European and in some American cities attempts have been made to meet these conditions by so-called "disposal plants," the object being to so treat the raw sewage that the effluent would be innocuous, while the solid, or semi-solid residue, would be left in a portable form.

Disposal plants, however, so far have either required a very large area to operate, with the resulting unsightly condition surrounding, or, if the area was curtailed, the efficiency, doubtful at the best, was negligible.

The Metropolitan Sewerage Commission, realizing the areas necessary to treat New York's sewage by any of the existing processes which gave promise of efficiency, were compelled to fall back on the construction of artificial islands in deep water, to which all the sewage would be conveyed by gigantic pumping operations. While this would probably be effective so far as the immediate vicinity of the city is concerned, the cost would be enormous, not only in construction but operation.

The problem then arose of finding a method of treating the sewage which would result in a removable residue, which method would not be in itself a nuisance.

With the hope of solving this problem, Boro President Maurice E. Connolly of the Boro of Queens has had a new method of sewage disposal tested by the chemist and engineers of his office. This method is of an electrolytic character, which promises to overcome many of the difficulties which have been encountered in the past. An experimental station which was installed at the Elmhurst disposal plant in the Boro of Queens last March, has been in continuous operation under scientific supervision of the boro laboratory since that date. These experiments were conducted with a full knowledge of previous work accomplished by the Metropolitan Sewerage Commission. No method of disposing of a sludge other than by taking it away in tank steamers or the delivery directly into the river has been devised.

Under the method tested, the plants would be constructed underground at the foot of each sewer outlet and the effluent discharged directly into the river, sterile and stable, while the sludge from the machines would be removed at once.

By reference to the report which has

been compiled in connection with the tests made, it will be seen that the rivers can be restored eventually to their natural condition and that the public bathhouses that the Department of Health was obliged to close can be opened to the city. Such a high degree of sterility is reached by this process that it will be possible to restore the oyster beds in Jamaica bay, which have been discontinued for several years past owing to the great pollution brought about by the discharge of raw sewage into the bay.

In the Metropolitan Sewerage Commission's report, it is shown that a large amount of sludge, which has accumulated and is accumulating at the outlets of the various sewers, must be provided for in some way. By the proposed method, the sludge is not discharged into the river, but is reduced to a dry, odorless and compact form, in which condition it can be readily handled and removed.

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¶ A RATHER FULL ABSTRACT *of the report of the chemist in charge of the experiment is given to show the nature and character of the work done.*

Following are some extracts from the report of P. M. Travis, chemist of the Boro of Queens, to which President Connolly refers:

The plant for electrolytic treatment of sewage was installed at the Elmhurst disposal plant, Boro of Queens, New York City, on March 26 for the purpose of observing the effect of the electrolytic and electro chemical method devised and patented by C. P. Landreth, of Philadelphia, for the treatment of sewage.

The apparatus used for experimental demonstration was one of the Landreth electrolytic process machines. Its capacity is 25,000 gallons per 24 hours and the dimensions 2 by 4 by 8 feet. It contains 5 banks of electrodes, 10 inches by 18 inches, spaced ⅜ inch apart, with 11 plates to each bank, thus making a total of 55 plates. The first bank of electrodes with which the sewage comes in contact are composed of carbon, while the remaining four are of iron composition. The apparatus is constructed with a heavy cast-iron base, which holds reduction gearing used for operating paddles which rotate between the plates. The action of these paddles insures uniform treatment of the sewage, breaks up all polarization and prevents any deposit from forming upon the electrodes. The power utilized for operating the apparatus was the regular 220-volt 60-cycle alternating current, available at the plant. This supplied, first, a 2-inch centrifugal pump, used to force the sewage thru the machine at the rate of 25,000 gallons per day; secondly, to operate a 5-h.p. motor generator, which in turn operated the machine proper and supplied the direct current used in the process; thirdly, a small motor used for mixing the milk of lime.

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¶ THE CHEMICAL REACTIONS *are given in full, showing the differences between this process and other electrolytic processes.*

The raw sewage is first drawn thru a ⅜-inch screen and after leaving the pump enters the electrolytic machine, thru an opening at one corner of the first plate in the bank of carbon electrodes, passes between the surfaces of the first and second plates and leaves at an opening in the second plate at the opposite corner of the bank. From here it passes between the second and third plates and leaves thru the third opening in the corner of the third plate, and so continues to pass back and forth thru the ⅜-inch spaces between plates of the electrodes until it has passed thru the entire carbon bank.

According to the theory of this process, while the sewage is passing between these electrodes, the sodium chloride (NaCl) present is broken up by electrolysis into its component ions or parts, according to the following equation: $NaCl=Na+Cl$, the sodium ions being liberated at the negative and chlorine ions at the positive plates, whereupon the sodium (Na) and chlorine (Cl) react with the water, forming sodium hydroxide (NaOH), hydrochloric acid (HCl) and hypochlorous acid (HClO) according to the following equations:

1. $2\,Na+2H_2O=2NaOH+H_2$.
2. $Cl_2+H_2O=HCl+HClO$.

By action of the rotating paddles, these resulting compounds are brought together and react as follows:

3. $2NaOH+HCl+HClO=NaClO+2H_2O+NaCl$. The sodium hypochlorite (NaClO) formed by the above given reaction acts as a germicide by oxidizing the organic matter, including the bacteria, the sodium hypochlorite (NaClO) giving off its nascent oxygen and returning to sodium chloride (NaCl) according to equation:

4. $NaClO=NaCl+O$ (nascent state).

The sewage after leaving the carbon electrodes passes between the iron electrodes in a similar manner. At the inlet to the iron electrodes, sufficient milk of lime is pumped into the sewage to make it alkaline. The electrolysis produced by the iron electrodes results as follows: The salts of iron, held in solution by the sewage, are changed to ferric hydroxide, $Fe(OH)_2$, which is coagulant and helps precipitate the colloidal matter. The electric current acts on the calcium hydroxide ($Ca(OH)_2$) causing the Ca ions to appear at the negative pole and the (OH) ions at the positive pole. As the OH ion is not an attacking ion, the electrodes are not decomposed, and the ions unite to form water and nascent oxygen. The oxygen produced being in a nascent stage acts as a germicide and oxidizing agent on the organic matter in solution and suspension. The calcium does not attack the iron, but unites with the water to again form calcium hydroxide (the same form of lime as introduced) and hydrogen. This hydrogen, being in a nascent state, combines with some of the nitrogen compounds in the sewage to form ammonia. The calcium hydrate is again broken up, and once more performs its function, the calcium reuniting with the water to form the calcium hydroxide and hydrogen gas. Thus the action is cyclic and the small amount of free alkali produces oxygen and hydrogen in proportion to the ampere flow of the current, without decomposition of the iron electrodes. At the same time, part of the lime has combined with the calcium bicarbonate in the water to form calcium carbonate in a hydrated flocculent form. It also forms with the carbonic acid in the sewage more calcium carbonate, hydrated. This coagulant, together with the resulting effects of the contact of the colloidal matter with the electrodes, whereby they give up their charges, which tend to keep them in motion, causes a very rapid precipitation of the suspended matter.

This completes the electro-chemical treatment, and the time consumed, as shown by phenolphthalein test, is approximately two minutes. From here the treated sewage is passed into a weir box, so as to provide means to measure the quantity treated, thence into a sedimentation tank, the dimensions of which are 11½ by 7 by 5 feet. Here rapid sedimentation takes place, a clear effluent flowing out at the top, while the sludge is drawn off thru an opening provided at the bottom. Phenolphthalein tests have shown that the clarified effluent leaves this tank in from ten minutes to one-half hour. The clear effluent was then conveyed to a concrete storage tank, which has a capacity of 67,000 gallons, where it was retained for observation, while the sludge was passed thru a press. The effluent and the liquid from the filter press were clear, odorless and non-putrescent, while the compressed sludge had a slight ammonia or lime odor.

The averages of the tabulated results of bacteriological counts of samples taken during the investigation are given in the accompanying tables:

AVERAGE OF BACTERIAL COUNT ON AGAR PLATES AFTER FORTY-EIGHT HOURS' INCUBATION AT 37 DEGREES C.

The total number of bacteria per cubic centimeter in the raw sewage varied from 1,000,000 to 3,600,000.

	May 10.	May 28.	June 2.	Aver.
Sewage directly after electrolytic, bacteria per c.c.	260	420	270	314
Effluent after passing thru small sedimentation tank, bacteria per c.c.	106	30	85	74
Effluent after storage in tank, bacteria per c.c.	170	455	135	254

AVERAGE OF COUNTS ON GELATIN PLATE AFTER FORTY-EIGHT HOURS AT 20 DEGREES C.

	May 28.	June 2.	Aver.
Sewage directly after electrolytic treatment, bacteria per c.c..	1,100	400	750
Effluent after passing thru small sedimentation tank, bacteria per c.c.	250	90	170
Effluent after storage in large tank, bacteria per c.c.	750	667	709

Bacterial removal or efficiency of sterilization is therefore close to 100 per cent.

Additional tests, made to verify the above results, were made and are shown in the accompanying tables for dates in July. All samples were allowed to incubate for 48 hours at 37 degrees C.

Date.	Dilution.	Count of Bacteria.	Bacteria per c.c.	Acid Forming Bacteria. Per c.c.	Count.	Per cent. of Reduction.	
July 14	1,000	1,000	1,000,000	7	7,000		Raw Sewage.
	1,000	1,200	1,200,000	..	.....		Raw Sewage.
	200	....	.....	50	10,000		Raw Sewage.
			199		2		After 20-ampere treatment.
July 20	1,000	2,940	2,940,000	20	22,000		Raw Sewage.
	10,000	360	2,600,000	2	20,000		Raw Sewage.
	.....	†	3,270,000	..	21,000		Raw Sewage.
	.....	....	115	..	.....		After 30-ampere treatment.
	.....	....	75	..	.....		After 30-ampere treatment.
	.....	†	95	..	.....	99.997	After 30-ampere treatment.
					12	99.943	After 30-ampere treatment.
July 22	10,000	136	1,360,000	11	110,000		Raw Sewage.
	1,000	1,220	1,220,000	..	.....		Raw Sewage.
	.....	†	1,290,000	..	.....		Raw Sewage.
	.....	....	1,560	..	.....	99.879	After 20-amp. 7.5-v. treatment.
					2	99.998	After 20-amp. 7.5-v. treatment.
	10,000	113	1,130,000	11	110,000		Raw Sewage.
	1,000	1,020	1,020,000	105	105,000		Raw Sewage.
	.....	†	1,075,000	..	107,500		Raw Sewage.
	.....	....	1,040	..	.....	99.819	After 30-ampere treatment for 1 hour 15 minutes.
	.....	....	1,400*	..	.....		After 30-ampere treatment for 1 hour 15 minutes.
	....	....	.....	..	28	99,974	After 30-ampere treatment for 1 hour 15 minutes.

The observations of the amount of dissolved oxygen in the samples, in parts per million, showed the following results at the same times, the report giving many prior determinations:

	Dissolved Oxygen in p.p.m.	Temperature.	Per Cent. of Saturation.
July 20—Raw Sewage taken at 11.30 a. m.	3.95	16 deg. C.	39.70
July 20—Treated effluent taken at 11:30 a. m. from sedimentation tank after treatment of 20 amperes	2.06	18 deg. C.	21.59
July 20—Raw sewage taken at 1 p. m.	0.00	16 deg. C.	0.00
July 20—Treated effluent taken at 1 p. m. from sedimentation tank after treatment of 30 amperes	2.71	18 deg. C.	28.41
July 22—Raw sewage taken at 10 a. m.	0.00	15 deg. C.	0.00
July 22—Treated effluent taken at 10 a. m. from sedimentation tank after 20 ampere treatment	5.26	18 deg. C.	55.14
July 22—Raw sewage taken at 11:15 a. m.	4.52	15 deg. C.	44.53
July 22—Treated effluent taken at 11:15 a. m. from sedimentation tank after 30 ampere treatment	5.42	18 deg. C.	56.81

Additional tests made from July 20 to 22, inclusive, of oxygen consumed in parts per million showed the following results:

July 20—Raw sewage taken at 11:30 a. m..... 61.6
July 20—Effluent from sedimentation tank at 11:30 a. m. after 20 ampere treatment 19.58
July 20—Raw sewage taken at 1 p. m..... 133.76
July 20—Effluent from sedimentation tank at 7 p. m. after 30 ampere treatment 26.4
July 22—Raw sewage taken at 10 a. m..... 268.95
July 22—Effluent from sedimentation tank at 10 a. m. after 20 ampere treatment 13.09
July 22—Raw sewage taken at 11:15 a. m..... 68.20
July 22—Effluent from sedimentation tank at 11:15 a. m. after 30 ampere treatment 17.82

Much of the reduction is doubtless due to the oxidation of the organic matter which takes place in the electrolytic treatment.

It is interesting to observe that when the sewage is concentrated the dissolved oxygen content is considerably increased by the electrolytic treatment, and that the oxygen consumed by the organic matter is enormously reduced, as, of course, would be expected after such treatment.

RESULTS OF CHEMICAL EXAMINATIONS OF SEWAGE BEFORE AND AFTER TREATMENT.

	Date	Raw Sewage	Directly After Treatment	Effluent from Small Sedimentation Tank	Effluent from Large Storage Tank
Nitrogen as Nitrites	May 19	0.40	0.40	0.56	5.00
	May 20	0.40	0.40	0.80	5.00
	May 23	0.56	0.56	0.72	5.00
Nitrogen as Nitrates	May 19	4.00	4.00	4.00	0.00
	May 20	1.60	1.60	1.60	0.00
	May 23	0.00	0.00	0.00	0.00
Nitrogen as Free Ammonia	June 2	33.00	.....	25.00	21.00
Total Nitrogen by Kjeldahl Method	June 2	70.00	.....	42.50	32.50
Chlorine Content	May 19	140.00	140.00	140.00	140.00
Turbidity	May 27	270.00	.....	55.00	15.00
	May 28	165*b*	.....	33.00	15.00
Color	May 27	124*a*	.....	33*a*	33*a*
	May 28	100*ab*	.....	27*a*	29*a*

a. Color is given in units on the platinum-cobalt scale.
b. After a heavy rain.

The nitrogen as nitrites in the effluent remains constant thruout the treatment, but increases upon storing and the nitrates decrease to zero. The decrease in the large tank of free ammonia and dissolved oxygen, as illustrated in the above tables, is perfectly consistent with the increase in nitrites, this being due to the breaking up of the ammonia and the oxidation of the nitrogenous matter by the dissolved oxygen in the water.

On May 28, samples were taken to determine the stability of the sewage after treatment. These samples were colored with methylene-green and allowed to incubate at 37 degrees C. On June 10, a sample of the effluent from the small sedimentation tank and also a sample from the large storage tank were removed from the incubator, having shown no signs of losing their color, thus showing that the effluent, after the electrolytic treatment, was non-putrescible.

The chlorine value thruout this treat-

ment remains constant; in other words, if the sodium chloride is converted into hypochlorites when in contact with the carbon electrodes, then in all probability it returns to its normal condition before the sewage treatment is completed, showing that the presence of chlorine ions is constant at all stages of sampling.

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¶ THE CONCLUSIONS *drawn in the report are most detailed in regard to the lime used in the process, perhaps because the amount used is so much more than is usual in sewage treatment.*

Detailed results of examinations for following the lime thru the process are given in the report which then presents the following conclusions:

Using the value of 7.8557 lbs. as the average lime content of the mixing tank, the quantity of lime which is pumped in twenty-four hours for the 25,000-gallon treatment, which is the condition under which these tests were made, is 31.4228 lbs., this giving a value of 1256.9 lbs. of lime per million gallons. Deducting the quantity of lime which it is necessary to use in softening the water, we have a value of 761.2 lbs. As 171.7 of lime as calcium oxide still remains in the large tank according to previous analytical data, this leaves 589.5 lbs. of lime which is actually consumed in the electrolytic treatment of sewage at Elmhurst. As calcium oxide is the active agent in the lime used, the actual cost per ton of lime used in this treatment would be in direct ratio to its purity. The lime used in the above experiments was 78.56 per cent. pure calcium oxide; thus to obtain the 1,256.9 lbs. of pure calcium oxide used per million gallons, it would be necessary to use about 1,600 lbs. gross of lime of this quality.

The cost of treating Manhattan sewage by this process would be much less than in Queens Boro, since analysis shows that this water contains only 3 p. p. m. of free carbonic acid and 33 p. p. m. total alkalinity calculated to calcium carbonate. From the above data it is readily seen that it would require 180 lbs. of lime per million gallons to soften this water. It would therefore require 315.7 lbs. less lime per million gallons than we are using in the Boro of Queens. Upon the basis of these calculations Manhattan sewage, if treated by the same process, would require 941.2 lbs. per million gallons for treatment.

It is also well to note that the time of sedimentation of the suspended and colloidal matter from the sewage after treatment by this process is reduced to a minimum. It requires less than an hour for complete sedimentation, thus eliminating the necessity of extensive sedimentation tanks and filter beds. The sewage treated for the above tests is normal domestic sewage with the exception that the contents of the cesspools of the locality are being carried to the plant and dumped into the receiving well at the rate of some hundred tank-wagon loads per day.

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¶ ODORS ARE ELIMINATED, *but the difficult sludge problem is not treated fully in the report.*

After the sewage enters the electrolytic apparatus there is no further offensive odor whatever from it. This method requires a small space, and the complaint of nuisance caused by the usual methods is avoided. An apparatus for treating 1,000,000 gallons in twenty-four hours is but 23 feet long, 4 feet wide and 3 feet high. It lies horizontally on the floor, the sewage flowing lengthwise with the electrodes, the paddles rotating in the direction of the flow of the liquid and actuated by the driving mechanism on the outside. Along the bottom of the box containing the electrodes pockets are arranged to catch the sand, with provision to draw it off, where it may be discharged into a receiving well.

In regard to the action upon the metallic plates which are used in the electrolytic machine, a composite sample taken every half hour on May 28 for a period of twenty-four hours showed an increase of only 2.06 p. p. m. of iron, thus showing that the electrolytic action on the iron plates is very small, this fact, no doubt, being brought about by keeping the sewage akaline with lime so that the hydroxile ions are in excess over the chlorine ions, thus overcoming the attack of the chlorine upon the iron plates, which

has been cited in previous electrolytic processes as one of the main drawbacks. The current used and generated by the motor generator for electrolysis on a flow of 25,000 gallons of sewage daily is 18 to 20 amperes, with a pressure of 7½ volts, or a power consumption of 135 to 150 watts, which is about 1.5 h. p. The carbon electrodes take about 0.9 of the current, the balance going to the iron electrodes; hence out of 20 amperes 18 go to the carbon and the remaining 2 amperes are seriesed eight times on the iron plates, giving an efficiency of 16 amperes on the iron. Estimating the power required per million gallons from the above figures, and remembering that with the increase of plate area in larger machines the voltage required to put thru a given amperage is proportionately reduced, about 6 k. w. should be sufficient to effect the high degree of purification obtained in these tests.

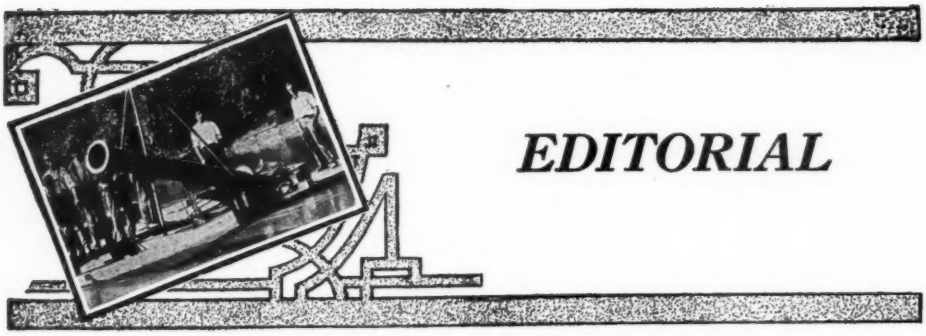
Without including pumpage, the necessity of which would have to be determined at each point of treatment, according to topography, the cost of electricity for electrolysis at the rate of six kilowatts per million gallons at a cost of 3 cents per kilowatt hour would be:

6 x 24 x .03	$4.32
Lime, 1,257 lbs., x .003	3.77
	$8.09

The attendance of these machines requires no high degree of technical skill and determination of the sanitary efficiency of the process at any moment is simple, since it is visibly manifested by the coagulation produced. It is necessary only to keep the sewage slightly alkaline by regulation of the lime and this can be tested in a moment with a drop of phenolphthalein which turns pink in alkaline solutions.

BANKING AND CREDIT SYSTEM IN SOUTH AMERICA

A manufacturer's view of the financial environment of the trade of the United States in Argentina, Brazil, Chile and Peru, given in a bulletin just issued by the Bureau of Foreign and Domestic Commerce, is of special interest at the present time, when American manufacturers are looking to that field for enlarged business. No attempt is made in the bulletin to provide a technical banking report; the facts presented concern the financial conditions surrounding American trade, the disadvantages under which our exporters labor, and the experiences of other nations that have considered oversea banking operations essential to their conquest of foreign trade. The bulletin contains lists of the principal foreign and native banks in these countries, a brief description of their monetary systems, a summary of their foreign trade, a brief outline of their banking laws, and a discussion of banking practice, credit-information service and exchange methods. A chapter is devoted to a discussion of the various methods suggested for establishing American banks in these countries and their field of operation. Copies of the bulletin (Special agents' series No. 90) may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents each.



EDITORIAL

THE MANUFACTURER AND THE NEW MARKETS.

Further observation and discussion shows the pertinency of last month's editorials on the manufacturers' present opportunity in foreign markets and that these markets are by no means restricted to other American nations, but are to be found all over the world, including the European nations, both those at war and those at present in peace. While the Government is doing all it can by promoting direct lines of steamers and branch banks and correspondents, as well as business agents in Government employ, it cannot supply the manufactured materials, nor, except in part and by way of advice, determine the individual methods of developing trade, packing and shipping goods, making collections and the like. These are the parts of the business which must be done by the individual manufacturer either directly or thru his authorized agents.

The same attention to taking care of the trade is necessary as with home trade, modified in accordance with local customs and prejudices, and really no more. The customs and prejudices are different, that is all.

Some observers, who are impatient at the apparent slowness of comprehension by the average manufacturer of his wonderfully and instantaneously enlarged opportunities, are disposed to complain because he does not rush in at once, but waits, seemingly to see what the results of the war will be. This state of mind is quite natural and is due to the average man's ignorance of foreign trade and its many peculiarities; to his fear, based on many years of large stories about the greater business ability of foreign merchants, particularly English and German shippers, that he cannot compete with them when they get back into the field; and to the consequent fear that he will ultimately, if not soon, lose the money he puts into the development of foreign business.

He may know of the successes of large corporations in foreign trade, such as the agricultural implement men, saw and saw-mill men, plumbers' goods makers, oil men, etc., but he cannot apply this knowledge to his own case, since his business is and must always be so much smaller.

There seems to be room, therefore, for organizations which can make the connections between the manufacturers in the United States and the customers in other countries. Organizations can do on a large scale what

single firms would not be justified in doing. They can establish the necessary agencies for promoting the use of goods, for keeping stocks of goods in the centers of distribution of each country, for passing upon credits of prospective customers and for making collections. They can prepare the necessary advertising material in the various required languages and distribute it, can make specifications for manufactured products to suit the needs of the customers, and for packing and shipping to meet transportation and custom-house requirements; see that manufacturers fulfil their contracts in these and other respects, and make the inevitable adjustments, when satisfaction is not given from accident or other cause.

Such an organization must be so constituted as to have or be able to gain promptly the confidence of both seller and buyer and should therefore have the best of financial rating in every country in which it does business and must go into the business to stay.

Such organizations are now in process of formation, some with ample provision for all parts of the business and others beginning with little knowledge of conditions and little capital on which to learn the business. Honesty and straightforward attention with equal assiduity to the business of all its patrons, both buyers and sellers, are the first essentials. The Chicago office of MUNICIPAL ENGINEERING is in position to give some valuable information in these lines.

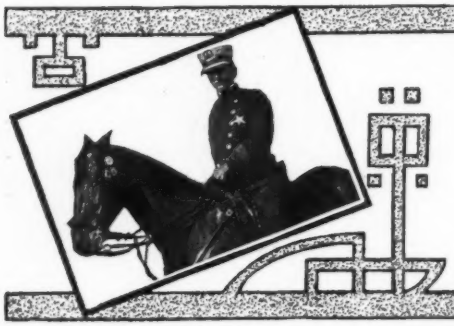
ELECTROLYTIC SEWAGE TREATMENT.

The official report of experiments in Queens Boro, New York City, with an electrolytic method of treating raw sewage, extracts from which are printed on another page, gives results which seem to be almost too good to be true. A careful study of the report and perhaps of the abstract will cause the reader to take the conclusions of the chemist, Mr. Travis, with some reserve until further information, as to portions of the process and its results not reported upon, is obtained and full estimates of cost are provided.

Thus there are discrepancies in statements as to amounts of electricity required and used, and no account is taken of the disposal of sludge, tho, judging from the results of chemical precipitation by means of lime, using perhaps half as much as in this electrolytic process, the disposal of sludge will be a very difficult problem, quantity alone being considered.

Again, the estimates of cost only include the cost of current and of lime, ignoring cost of operating the apparatus, renewing parts of the electrolytic apparatus, removing and disposing of sludge, and overhead charges, so that no definite comparison of relative efficiency, including economy, of this process with others in use can be made with the data at hand.

The indications are of interest, and point to further detailed experiment under careful measurement and accounting of costs as well as bacteriological investigations.



QUESTION DEPARTMENT

How to Fix Water Rates

Will you please suggest means of ascertaining the basis on which water rates are fixed in various communities of 30,000 to 50,000 people? Our citizens association feels that the local rate is too high, but even the recent publication by a committee of the American Water Works Association does not give us a properly detailed explanation of rates so that we can use that as an argument before our State Corporation Commission.

P., ———, Va.

In the past the tendency has been to make the charges for service by a public service corporation what the traffic would bear, the service very often being worth actually more than could be charged for it. But since it has been recognized that the services rendered are true monopolies and must be so treated if full economy is practiced, and that these monopolies belong to the people who have granted permits to operate them, the practice has been to base the charges on the cost of the service rendered, when all the elements of that cost have been considered.

In the case of a water supply the cost is made up of the following principal elements, with many minor items of related nature:

The cost of the property, including real estate, water plant, reservoirs, lakes, wells, conduits, pumping stations, distribution pipes, service pipes, meters, etc. The annual cost of this item includes interest, sinking fund, depreciation, maintenance and repairs, etc.

The annual cost of operating the plant, including fuel, labor and materials, keeping of accounts, billing and collecting, inspecting, purification, etc.

The total annual cost of supplying the water is thus obtained quite accurately, much of it from the books of the company showing expenditures and much from rules and customs now becoming well standardized.

Rates for water to produce revenue sufficient to meet all these expenditures and charges, and only enough more to supply a reasonable fund for accidents, fluctuations in business, and the like, can then be worked out. The proportion which the city should pay is now quite readily obtained by methods which have been standardized. Given the schedules of rates in force, they can be decreased or increased proportionately to bring the gross revenue to the figure required, or the opportunity can be taken to revise any of the rates which seem to be inequitable.

Future developments may change conditions so that the rates thus fixed may become inequitable. Provision is made for revision of any rate or rates when this develops. The increase or decrease in value of the franchise belongs to the community, and it should profit by the one or lose by the other. Rates should therefore be increased or decreased to put the burden where it belongs. In one or two places a safety fund is provided for, and when this fund decreases below a certain fixed amount or increases above a certain other fixed amount, the rates are automatically increased or decreased by a unit or a percentage. In most cases, however, the rates continue as fixed until their inequity becomes too apparent to be ignored and one party profits and the other suffers during the time that this inequity is developing to the acute stage.

The above is a brief statement of some of the principles underlying the determination of rates. There are many details which have been discussed very fully by engineers and attorneys interested in the various cases which have arisen. Perhaps the source of the fullest information is the publications of the Wisconsin Railroad Commission and its members. Several members of the commission, past and present, have written papers summarizing the results of their labors. If these reports are not available in local libraries, most of them can be obtained from the commission at Madison, Wis. Copies of the papers and lectures by commissioners can also be obtained from them.

So far as water rates are concerned, the publications of the American Water Works Association for several years have contained excellent developments of various parts of the many subjects involved.

These can be obtained of the secretary, John M. Diven, Troy, N. Y.

The back numbers of MUNICIPAL ENGINEERING are full of articles on this line. Thus in the last volume, xlvi, are the following:

"Pasadena's Electric Light Plant," p. 41.

"Effect of State Regulation of Public Utilities," p. 168.

"Compensation for Telephone Franchise," p. 378.

"Securing an Equitable Franchise for Public Utilities," p. 380.

"Modern Contracts with Public Service Corporations," p. 460.

"Comparison of Operations of Private and Municipal Plants of Pasadena, Cal.," p. 462.

"Rate Making for Public Utilities," p. 520.

"Regulation of Capital and Rates of Public Service Corporation," p. 571.

Expansion of Concrete

Will you kindly inform me as to the theory of expansion and contraction of concrete. Is there provision for expansion in all concrete work or is there only a certain class of concrete work which is provided with expansion joints. I have seen concrete roads in Pennsylvania and Connecticut and these had an expansion joint every fifty feet transversely across the road. Recently I have seen the great Yale Stadium in the course of erection and have been told by an inspector there that in the lower wall, the large retaining walls and all of the tunnels, thirty in all, there is no provision for expansion. There was some provision made in the construction of the seats. This, he explained, was done to allow for the settling of the earth, being on a fill, rather than for expansion and contraction. I understand that the construction of roads is different from the construction of walls, but I would like to know when and where expansion joints should be provided, if it is the best practice to do so. S., Philadelphia, Pa.

The expansion of concrete per degree of increase in temperature is not far from that of steel. It must be provided for in some way. If the variation in temperature is slight, the provision required will be less than if that variation is large. Not only expansion but contraction must be provided for, and it is probable that most of the so-called expansion cracks in concrete are really contraction cracks.

A wall or a pavement exposed to the sun requires much more ample provision for expansion and contraction, if cracks are objectionable, than a mass of concrete or than floors or walls which are inclosed and not subject to great variations in temperature. Indeed, the allowable changes in form of a structure and the ability of the concrete to withstand internal strains, compressive and tensile, may in many cases of the latter sort be sufficient to prevent any injury.

The temperature cracks in a road surface are due to contraction and to expansion. The longitudinal cracks are probably due to expansion, which causes the arch made by crowning the roadway to rise, and, when and where it breaks, the crack is formed. The concrete not being laid at the lowest temperature to which the road is subject, the contraction of the concrete is most to be feared in the longitudinal dimension of the road. Since the tensile strength of the concrete is much less than its compressive strength, contraction cracks are almost sure to appear at intervals of 30 to 50 feet. For this reason so-called expansion joints, which are really contraction joints, are put into the road from 30 to 50 feet apart. Since the road is ordinarily laid in the summer season, the expansion under summer heat can ordinarily be taken up by the ability of the concrete to withstand the compressive stresses caused by the increase in temperature, and real expansion joints are usually not needed. In brick pavements laid in cold weather there have occasionally developed breaks and even explosions due to such expansion. The same have occurred in cement sidewalks, and will doubtless occur in concrete streets wherever a change in grade is made or a break in continuity of surface by changing form of cross-section at a street or alley intersection. These cases are comparatively rare, but are worse in concrete walks and streets than in brick, because the expansion of concrete is approximately double that of brick per degree of increase in temperature.

Some engineers are using some of the lighter forms of steel reinforcement near the outer surfaces of concrete pavements and walls to carry the tensile stresses set up by reductions in temperature, hoping in this way to reduce the number and size of temperature cracks, and they have met with considerable success.

An outside wall, especially a retaining wall, which is not so free to move as the wall of a building, is subject to the same expansion and contraction under rhanges of temperature as the pavement, and if its ability, plain or reinforced, to resist internal stresses, or its freedom to move is not sufficient, cracks will develop, which, again, will ordinarily be contraction rather than expansion cracks.

It should be noted that the term "temperature cracks" is ordinarily used, not to apply to the thru cracks covered by this discussion, as it is used above, but to cover the fine or superficial cracks of no serious depth due to the greater changes in temperature in the surface of the wall than in the wall as an entirety.

Each concrete structure has its own expansion and contraction problems. Most of them are taken care of in reinforced concrete buildings by the reinforcement

and by the comparative freedom for the changes in form due to changes in temperature. In other structures, the reactions against foundations and surroundings, the internal stresses in walls, floors, arches above or below, reinforcement, etc., must be designed to reduce or remove to a reasonable distance the danger of cracks, or they must be localized, as desired, by proper joints. It is evident, therefore, that any important structure should be designed by an engineer with education and experience in the qualities of concrete, plain and reinforced, with full consideration of the tendencies toward changes in form which will occur with changes in temperature.

Ordinance Establishing Municipal Market

This organization is investigating the city market question with a view to establishing a market in this city. It has occurred to me that you may be able to refer us to some interesting articles on the subject.

RAYMOND B. GIBBS,
Secretary Chamber of Commerce,
Olean, N. Y.

The most exhaustive study of marketing conditions and methods of meeting them which has been made recently and on modern lines is that of the Chicago Municipal Markets Commission, of which Alderman James H. Lawley is chairman. Copy of it can probably be obtained from him or from the Chicago Association of Commerce. A brief review of the conclusions of the report and the proposed revision of the Chicago marketing system will be found in the September number of MUNICIPAL ENGINEERING, vol. xlvii, p. 238.

The mayor of Des Moines, Ia., made some excellent reforms in the operation of the public market in that city, which he has described in lectures delivered at various places. Probably he could supply at least a newspaper report of the lecture and some hints as to matters to avoid and to insist upon in the establishment of a market.

There are two main reasons for establishing a city market, one to bring producer and consumer nearer together, and the other, most closely related, to keep prices down by eliminating the commission merchant from the market and preventing combinations in restraint of shipment of perishable foodstuffs into the city.

Rochester, N. Y., has a very successful wholesale market which more than pays expenses and controls prices to a considerable extent. But a small city needs a retail market and may need to restrict wholesaling or the purchase by commission merchants of market commodities from farmers on their way to market, "forestalling," as it is called in market ordinances of a past generation. Stalls in a market should be rented at low prices and for such terms that the producers can afford to rent them. On the other hand, local merchants may have just cause for complaint if the stalls are free.

In one city where the market was operated in such way as to pay expenses only, a new administration made some large improvements and desired to repay itself for these improvements. It was soon found that higher rents for stands could not be charged unless the stands were rented by the year. They then fell into the hands of commission merchants, their agents or aids, farmers requiring them all the year not being numerous, and the farmers were crowded out to stations along the curb during the growing season. The city made money, but the combinations pushed up prices until most of the advantage as to prices was lost.

The city of New York has made some valuable reforms in its municipal markets recently, one making them free, and results are reported to be excellent. These have not been under way long enough to be reported other than in the daily and weekly press. Information can be obtained on application for it thru the mayor of the city.

An illustrated description of a handsome little concrete market at Ft. Wayne, Ind., will be found in MUNICIPAL ENGINEERING, vol. xlvi, p. 288.

Clinton Rogers Woodruff, secretary of the National Municipal League, North American Building, Philadelphia, Pa., can give valuable information on the problem of establishing municipal markets.

A full market ordinance is too long to print here, but the following outline may be of service:

Location is defined, describing buildings, areas and curb lines bounding market spaces on streets and adjoining sidewalks and property.

Plats of stalls and stands are provided for from which to locate stands and leases.

Definitions are given for such terms as City Markets, Stalls, Benches, Stands, Curbstone Stands, Marketer, Engrossing, Forestalling, Regrating.

Appointment and duties of market master are provided for.

Market master's duties are defined, and he can enforce cleaning of stalls, settle disputes, etc., and is given special police powers.

Market days and hours are fixed.

If the city does not have an inspector of weights and measures, the market master should be provided with standards and enforce them.

Annual fees for stalls, etc., inside market houses, and daily fees for outside and

curbstone stands are fixed annually by board. Provision that stands be auctioned off to highest bidders is probably not good, as it tends to force out those specially wanted in the market and to develop combinations to fix prices.

Forfeitures of leases are provided.

More than one stand not rented to a single tenant except on special grant by board.

Transfers of leases are forbidden.

Barring of marketers, revocation and surrender of leases and leasing of surrendered stands are provided for.

Standing of horses and vehicles about and near market and at curbstone is regulated.

Unrented stalls can be rented on daily payments.

Stands outside defined market limits are prohibited, also use of market stands or spaces without lease, daily or annual.

Cleaning of stands by occupants is required.

Sale of meat is regulated, also cleanliness of stalls used therefor.

Selling or buying from stands before market hours, forestalling, engrossing, regrating, presence of dogs in market, stationing wagon before midnight, sale of unwholesome provisions, meat, fowl or fish, bull, boar or ram meat, unfresh eggs, are prohibited.

Shape and size of dry measures are defined.

Killing of animals, fish or fowls in stand, trespassing in stall, disfiguring market house, hitching to market house, obstructing passageways of or streets near market house or sidewalks, idling about market house, sales from vehicle without license, auction sales, itinerant venders and outcrying goods are prohibited.

Penalties are provided for violation of provisions of ordinance.

Garbage Reduction Systems

I would like to have a list of names of manufacturers of garbage disposal plants, of sizes suitable for cities of 100,000 population, that treat and handle the garbage to turn it out as fertilizing material.

S., ———, Iowa.

The firm named manufactures apparatus and builds plants for garbage reduction and has some patents on machinery and processes. This method of disposing of garbage seems to be of particular value in the larger cities of more than 100,000 population, tho one small city, of about 15,000 population, has a reduction plant on the Wiselogel system which is reported to be successful.

Cleveland and Columbus, O., have municipal garbage reduction plants which are said to be financially successful, tho cost of collection is not considered and no comparisons of total cost of collection have ever been made between their systems and others. The Cleveland plant has machinery made by the company mentioned by our correspondent, and possibly also the Columbus plant. The latter plant was designed by I. S. Osborn, an engineer of experience in the construction and operation of garbage reduction plants, and was operated by him until it was in full working order, and it contains machinery made by several of the manufacturers mentioned in the answer to another question on this line, appearing in this department this month.

These two are the only municipally operated garbage reduction plants known to the writer, but there are many in operation by private companies.

Schenectady, N. Y., has just completed a garbage reduction plant, the success of which will soon be tested. It is a city of less than 100,000 population.

Cincinnati, Dayton and Toledo, O., Boston and New Bedford, Mass., New York City, Baltimore, Md., Philadelphia, Pa., Newark and Atlantic City, N. J., Wilmington, Del., Detroit, Mich., Indianapolis and Vincennes, Ind., Washington, D. C., Syracuse, N. Y., Reading, Pa., Rochester, N. Y., are among the cities which have had greater or less success in letting contracts to companies for the reduction of garbage.

MUNICIPAL ENGINEERING has published a number of articles on garbage reduction and other methods of disposal. In the current volume, xlvii, are the following: "Street Cleaning and Refuse Disposal in Philadelphia," p. 19; "Profitable Conversion of City Garbage," p. 25; "Vancouver Garbage Collection and Disposal Ordinance and Methods," p. 41; "The Harris Municipal Garbage Incinerator and Steam Generator," p. 72; "Garbage Incinerators and Destructors," p. 114; "Garbage Disposal by the Hirsh Chemical System," p. 131.

Several articles will be found in the preceding volume, xlvi, and on p. 237 is a list of the more important articles in several earlier volumes.

Coal Pulverizing Machinery for Cement Manufacture

Can you give me the address of one or more reliable parties or firms making a business of designing complete outfit for powdering coal, as used for burning cement in rotary kilns?

Will you kindly advise me, if you can, the minimum, average and maximum weight of powdered coal, required, in general use for burning a given quantity (if barrel, give number of pounds) of cement clinker?

L. M., Philadelphia, Pa.

Among manufacturers of coal pulverizers of various sorts are the Jeffrey Mfg. Co., Columbus, O., who make pulverizers

for use in the fuel plants as well as the cement-grinding plants of cement mills; Allis-Chalmers Co., Milwaukee, Wis.; Abbe Engineering Co., New York; C. O. Bartlett & Snow Co., Cleveland, O.; Bethlehem Foundry and Machine Works, South Bethlehem, Pa.; Bonnot Co., Canton, O.; Bradley Pulverizer Co., Boston, Mass.; Geo. V. Cresson Co., New York; Power and Mining Machinery Co., Cudahy, Wis.; F. L. Smidth & Co., New York; Strong, Carlisle & Hammond Co., Cleveland, O., and many others.

The amount of coal used in burning cement varies according to the kind of kiln used, whether wet or dry process is used and the kind of coal, from, say, 12 per cent. of the weight of the clinker produced to 60 per cent. Including the coal used in producing the power used about the plant, it is sometimes roughly stated that a pound of coal is required to produce a pound of clinker, but this is usually an exaggeration. The rotary kiln requires from 100 to 175 pounds of coal to produce a barrel of finished cement, 376 pounds of cement at 94 pounds per sack, and may under favorable circumstances shale the lower figure, counting only coal used in the kiln.

Topeka Specification Asphaltic Concrete

Can you inform me as to what is the largest size aggregate and what is the largest percentage of it that may be used in "Topeka" mixture or asphaltic concrete without infringing on the Warren Brothers patents? Also, if any asphaltic concrete even if containing large sizes of aggregate does not infringe on these patents if not used for wearing surface. I would appreciate any information you can give me on this.

A., City Engineer, ———, Ariz.

Several questions of this nature having been asked, the following, which is reported as from the decree in the Topeka case, and to constitute the so-called Topeka specification, is given:

"Any pavements hereafter constructed in substantial compliance with the following formula, to wit:

"Bitumen from 7 to 11 per cent.

"Mineral aggregate passing 100-mesh screen, 5 to 11 per cent.; 40-mesh, 18 to 30 per cent.; 10-mesh, 25 to 55 per cent.; 4-mesh, 8 to 22 per cent.; 2-mesh, less than 10 per cent., sieves to be used in the order named, would not infringe the claims of said patent."

The Association for Standardizing Paving Specifications adopted a specification for asphaltic concrete which they thought would give the best results, but refused to pass upon its freedom from infringement of patents. The American Society of Municipal Improvements has not yet attacked the question, tho a committee has been at work upon it for some years. A report from the committee is expected at the Boston convention of October 6-9.

Plants Making Fertilizer from Garbage

Will you have the kindness to give me your opinion regarding the —— company's system of treating city garbage. Their system's purpose is to obtain from the garbage all the commercial products that can be derived from it. Have you written anything in MUNICIPAL ENGINEERING regarding this matter? If so, kindly let me know what numbers. Do you know of any cities that have this system in practice? Do you consider it the best?

E., ———, Costa Rica.

The tankage from garbage reduction plants is used as fertilizer. These plants are individually designed, using machinery more or less standardized by such makers and designers as the American Extractor Co., Providence, R. I.; American Process Co., New York; American Reduction Co., Pittsburg, Pa.; C. O. Bartlett & Snow Co., Cleveland, O.; Edson Reduction Machinery Co., Cleveland, O.; Kutztown Foundry and Machine Co., Philadelphia, Pa.; Penna Construction Co., Marietta, Pa.; Sanitary Product Co., Philadelphia, Pa.; Buffalo Foundry and Machine Co., Buffalo, N. Y.; V. D. Anderson Co., Cleveland, O.; F. D. Cummer & Son, Cleveland, O.; Ruggles-Coles Engineering Co., New York.

Dr. J. M. Hirsh, Chicago, Ill., is developing a chemical method of treating garbage, which will produce a fertilizer. His process was described in MUNICIPAL ENGINEERING for August, vol. xlvii, p. 131.

Methods of Collection and Disposal of Garbage

Will you kindly inform me whether there is anywhere to be obtained a reasonably full statement of the practices of the various cities of the Union in regard to the collection and disposal of garbage? I answered for Mobile a set of questions sent to me by one of the engineering publications, I thought it was yours, some months ago, but have never seen any mention anywhere of any compilation of the facts.

It is my belief that this city stands at the head in its handling of this problem, as it takes up not only all garbage, but all waste, including ashes, trimmings, tin and other debris daily, save in a very limited outside area, where it is taken up three times a week, and all without charge to the citizens.

HARRY PILLANS,
Commissioner of Streets and Public Works,
Mobile, Ala.

Statistics as to methods of garbage collection and disposal were collected by MUNICIPAL ENGINEERING some time ago but were so unsatisfactory that they have never been published, being almost wholly excellent descriptions of how not to do it. Several articles were written to show the principles which should be followed

and will be found under appropriate titles in MUNICIPAL ENGINEERING, vol. xl, p. 106; vol. xxxix, p. 286; vol. xlii, p. 183.

Some details of methods of collection and disposal in various cities, about 50 in number, will be found in articles in vol. xl, pp. 348, 445; xxxix, pp. 275, 286; xxxv, p. 8; xxx, p. 34; xxviii, p. 393; xli, p. 61; xliii, p. 327; xlii, p. 385 in Ohio cities.

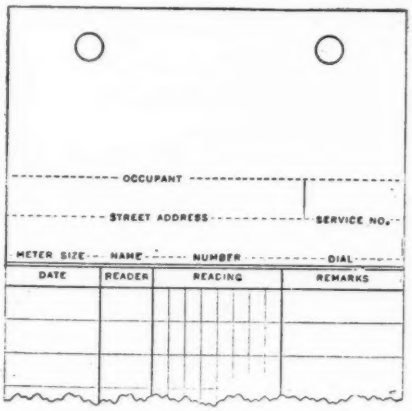
A classified list of articles on the various phases of the problems of garbage and refuse collection and disposal in many cities is given in vol. xlii, p. 252.

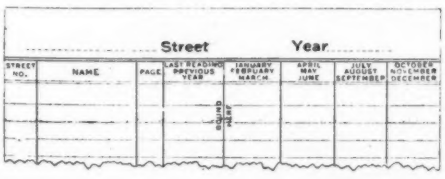
Meter Reading Records.

The writer is in the market for some meter reading records such as used by water companies. W., ———, Pa.

Accompanying are reproductions of headings of two forms of meter reading records which can be supplied by the Buffalo Meter Co., of Buffalo, N. Y. One shows a removable slip, two or three hundred of which are carried in a holder of aluminum, leather or board, which can be arranged in the order of the reader's route and removed for transcribing in the office books. The other shows two pages forming the double page of a pocket meter-reading book, of 100 double pages of 20 lines each, so that one book will hold the quarterly readings for a year of 2,000 meters. This book is bound in stiff drab canvas with flap.

The American Water Works Bookkeeping System, published by Engineering Publishing Co., Indianapolis, Ind., contains the best meter account book, to which the readings recorded in these pocket meter reading books or slips can be transferred and the customers' accounts kept conveniently and in proper form.





Who Designs Park Fountains?

A local organization of women has a fund of thirteen hundred dollars for the erection of a fountain in our city park which is at present being built. Can you advise us how best to secure plans and designs for the same?
Y., ———, Mont.

Will our readers refer us to any architects or sculptors who would make the design desired?

Designs in cast or wrought iron and stone, not always the most artistic and not distinctively individual, can be purchased of such manufacturing firms as F. P. Smith Wire and Iron Works, Chicago, Ill.; Stewart Iron Works Co., Covington, Ky.; J. L. Mott Iron Works, New York City.

Repainting Leveling Rod

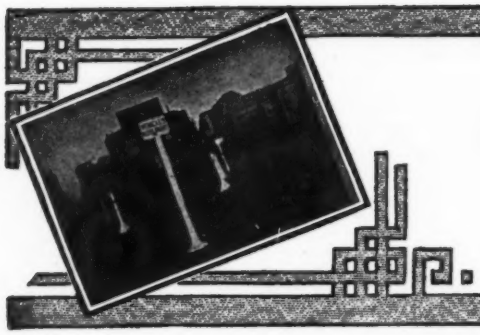
I want to get made a stencil plate that will fit one foot of my Philadelphia leveling rod. Some of the figures and division marks on it have become indistinct by use.
B., ———, Mo.

The makers of leveling rods can make such stencils as are desired. It may be that it would be less expensive to send the rod to the instrument makers to be repainted than to buy the stencil, and it would also be more satisfactory. Manufacturers nearest our correspondent are Chicago Steel Tape Co., 6229 Cottage Grove avenue, Chicago, Ill.; A. S. Aloe Co., 513 Olive street, St. Louis, Mo.; Eugene Dietzgen Co., Chicago, Ill. W. & L. E. Gurley, Troy, N. Y., can do the work or supply the stencil.

Information About Management of Municipal Cemetery

Could you direct us to a house, firm, publication or book, from whom we could procure information relative to the business management of a cemetery? What we would like is sample ordinances governing cemeteries, cemetery record books, burial permits, deeds to lots and lot registers and everything pertaining to the business management of a municipal cemetery.
G., Mayor, ———, Wyo.

Will our readers give references to sources of the information desired, for the benefit of our correspondent? *Park and Cemetery* is a monthly published at Chicago which can probably supply the material desired.



WORKERS IN THE FIELD

Burned Asphalt Cement Can Be Prevented

The Editor of MUNICIPAL ENGINEERING:

Sir—I have read the article in your September number on "Burned Asphalt Quite Unnecessary," written by Mr. Geo. C. Warren, and in which he quotes Mr. Hetherington.

Mr. Warren commences by stating that "apparently the article in the July issue was written by some one interested in the building of asphalt paving plants of a special type providing for steam heating the asphalt cement," and then writes a long treatise on different methods of constructing furnace heated kettles in a manner which he himself admits is very unsatisfactory, as should the asphalt cement become too hot "it is necessary to shut down the dryer fire, which cannot be shut off without closing down the entire plant." He consequently admits that it is possible to overheat a furnace-heated kettle (see ninth line, fifth paragraph), so we agree on this point.

Mr. Hetherington states: "But the real question is this: can you obtain 350 degrees F. of temperature from steam at 125 pounds pressure?" The statement was that "the asphalt cannot exceed 350 degrees F." His argument, however, substantiates the statement that by the use of steam heat the asphalt cannot be overheated.

Mr. Warren then classifies the statement, "'With furnace heat applied to the exterior of the kettle at a temperature of at least 1200 degrees F.' the asphalt cement is necessarily burned," as absolute "buncombe," and then goes on to give a steam boiler as an example. Just how he reasons that asphalt will conduct the heat away as rapidly as water I cannot understand. Asphalt is a very poor conductor and would prove disastrous to any boiler crown sheet as a consequence. However, if 1200 degrees F. is all "buncombe," then let me ask Mr. Warren what burns the bottoms of furnace-heated kettles when, as he admits, "an abnormal coating of sediment and coke (where did the coke come from if no burning took place?) has been allowed to collect?" I have seen numbers of kettle bottoms "bagged" (due to carelessness), in which case the steel has been sufficiently hot to allow it to bag down as much as four inches. Will you allow, say, 1800 degrees F. for this, Mr. Warren? In other cases I have seen them not only bagged, but burned to a blister, so that the least little tap with a hammer would go through. Shall we allow at least 1800 degrees F. for that also? This was also due to carelessness.

This talk about brick arches and other forms of protection sounds all right, but, in practice, the brick work generally gets shaken down in transit thru freight yards and frequently stays down, and if the average plant foreman has the same ideas as to asphalt and water conducting heat as Mr. Warren has, he ought not to be criticised for following an authority of some thirty years' experience, even altho the said authority happens to be mistaken.

Mr. Warren's admissions that asphalt can be overheated in a furnace-heated kettle if the operator is careless, and that an abnormal sediment of coke can collect, simply bears out statements made in the article in your July issue. Mr. Hetherington's statements that 350 degrees F. cannot be obtained from 125 pounds steam pressure still further emphasizes the safety of using steam heat and the impossibility of a careless night man burning the asphalt cement.

Mr. Warren quotes pavements that have not had the A. C. burned by furnace heat, but he does not quote those in the United States that have had. If steam heat had been used on all of them, there would not have been a single instance of a street having been laid with burned asphalt cement. Mr. Warren claims to have had thirty years' experience in the handling of refined asphalts. The writer has not only had a number of years' experience in handling refined asphalts, but has also refined asphalt. It would be interesting to hear from Mr. Warren just what is taking place in a perfectly clean kettle,

where, as he says, the kettle bottom "is never more than 20 degrees F. hotter than the asphalt cement at top of the kettle," but which, in spite of his assertions, forms bubbles, which, upon reaching the surface, burst and liberate heavy yellowish gray smoke. What is Mr. Warren's explanation of this phenomena? Also, what causes so much free carbon in some of the oils which have been treated with 1200 degrees F., as some of them are?

If Mr. Hetherington and Mr. Warren will stick to what is written and not inject theoretical interpretations, with a lengthy discussion of the same, we shall no doubt in time all arrive at the conclusion that a furnace that is capable of burning up the steel bottom of an asphalt kettle is also capable of burning the asphalt in the kettle, and by further experience Mr. Warren may discover that the conductivity of asphalt and water is entirely different. He will also discover, if he makes inquiries, that there are no railroad asphalt plants on which it is necessary to "shut down the dryer fire" to cool of the A. C. kettles.

By way of proving up their contentions I will defy both Mr. Warren and Mr. Hetherington to operate their automobiles after the engine water jackets, radiators, etc., have been filled with asphalt instead of water. They should be able to do this if, as they would lead one to infer, a steam boiler is the same as an asphalt kettle, and, if which is true, the absorption of heat in a given time is the same in both cases. SUBSCRIBER.

Trigonometric Tables of Grads

The Editor of MUNICIPAL ENGINEERING:

Sir—If your inquirer signing his name as L., ———, Conn., p. 215, September issue of MUNICIPAL ENGINEERING, will write to the undersigned, I can furnish him with a set of F. G. Gauss' *Four-place* Logarithmic Trigonometric Tables, *Decimal System;* that is, 100 degrees to the quadrant, 100 minutes to a degree and 100 seconds to a minute. The tables do not give "naturals," but they give, for the whole quadrant, the logarithmic sines, cosines, tangents and cotangents, for each degree to every 10 minutes and with proportional parts for quick interpolation. Also, the constants for Pi in its varied uses, the length of the radius in degrees of arc, and full instructions, in German, for the use of the tables. The tables I have are absolutely new, never used, and were imported by the writer some years ago from Berlin, Germany. I have likewise the four-place ordinary trigonometric tables by the same author, which were imported from Berlin at the same time, all new, but only two or three sets of each kind can be furnished. The inquirer must write me at once if he wishes to secure a set of these tables.

L. C. HJORTH,
Meadowdale, Wash.

Regulating Growth of Organic Matter in Reservoirs

The Editor of MUNICIPAL ENGINEERING:

Sir—Your August issue contains a very interesting abstract of a paper presented before the Franklin Institute by Prof. W. P. Mason. This article, and the one in which it is abstracted, are of special interest to me as showing that the copper sulphate process for destroying algae is treated as a standard method of sanitary practice.

In quoting a table from an article of mine, Professor Mason has made the same error which was made in abstracting this paper for "Wasser und Abwasser." I refer to the list of algae headed "Number of Observed Cases." In the original this table is given under the heading, "Showing the Occurrence of Genera, etc." I had used "occurrence" in the sense of "geographical distribution" in this table, and that fact is, unfortunately, not brought out by the quotation in Professor Mason's article. It was my intention to show the variation in the geographical distribution of the organisms most frequently reported as troublesome, and an organism is not listed as present in a state unless it has been frequently reported. KARL F. KELLERMAN,

Physiologist in Charge, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

The table referred to reads as follows in the abstract referred to:

TABLE II—SHOWING OCCURRENCE OF TWELVE GENERA OF ALGAE MOST FREQUENTLY REPORTED AS CAUSING TROUBLE IN RESERVOIRS AND PONDS.

	No. of cases.
Anabaena	27
Asterionella	9
Beggiatoa	20
Chara	26
Cladophora	17
Clathrocystis	23
Conferva	56
Crenothrix	13
Fragilaria	19
Navicula	21
Oscillatoria	49
Spirogyra	43

The table in the original paper is as follows:

TABLE SHOWING THE OCCURRENCE BY STATES OF GENERA OF ALGAE MOST FREQUENTLY REPORTED AS CAUSING TROUBLE IN RESERVOIRS AND PONDS

	Anabaena	Beggiatoa	Asterionella	Chara	Cladophora	Clathrocystis	Conferva	Crenothrix	Fragillaria	Navicula	Oscillatoria	Spirogyra
Arkansas	—	—	—	—	Y	—	—	—	Y	Y	—	—
California	Y	Y	—	—	Y	Y	Y	—	Y	Y	Y	Y
Colorado	—	—	Y	Y	—	—	Y	—	—	—	Y	Y
Connecticut	Y	—	Y	—	—	Y	Y	Y	—	—	Y	Y
Dist. of Columbia	—	—	—	—	—	—	Y	—	—	—	Y	—
Georgia	—	—	—	Y	—	—	—	—	—	—	—	—
Idaho	—	—	—	—	—	—	—	Y	Y	—	Y	Y
Illinois	—	—	—	—	Y	Y	Y	Y	—	Y	Y	Y
Indiana	—	Y	Y	—	—	—	Y	—	—	—	Y	Y
Kansas	—	—	—	—	—	—	Y	—	—	Y	Y	Y
Kentucky	Y	Y	—	—	Y	Y	Y	Y	—	—	Y	Y
Louisiana	—	—	—	—	—	—	Y	—	—	—	—	Y
Maine	—	—	Y	Y	—	—	—	—	—	—	—	—
Maryland	Y	—	—	—	—	—	—	—	—	Y	Y	Y
Massachusetts	—	Y	—	Y	Y	Y	Y	—	Y	—	Y	Y
Michigan	Y	—	—	Y	—	Y	—	—	—	Y	—	—
Missouri	Y	—	—	Y	Y	Y	Y	Y	Y	Y	Y	Y
Minnesota	—	Y	—	—	Y	Y	—	Y	—	—	Y	—
Montana	Y	—	—	—	—	—	—	—	—	—	Y	—
Nebraska	—	—	—	—	—	Y	—	—	—	Y	—	Y
New Hampshire	—	Y	Y	—	—	—	—	Y	—	—	—	—
New Jersey	Y	Y	—	Y	Y	Y	Y	—	Y	—	Y	Y
New Mexico	—	—	—	Y	—	—	—	—	—	—	Y	—
New York	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ohio	—	Y	—	Y	Y	—	Y	—	—	Y	Y	Y
Oklahoma	—	—	—	—	—	—	Y	—	—	Y	—	—
Pennsylvania	Y	Y	Y	Y	—	—	Y	—	Y	Y	Y	Y
Rhode Island	—	—	—	—	—	Y	—	—	—	—	—	—
South Carolina	—	—	—	—	—	—	Y	—	—	—	—	—
South Dakota	—	—	—	—	—	—	Y	—	—	Y	Y	Y
Tennessee	—	—	—	Y	—	—	—	—	—	—	—	—
Texas	—	—	—	Y	—	—	Y	—	—	Y	Y	Y
Vermont	—	—	—	—	—	—	—	—	—	Y	Y	Y
Virginia	—	Y	—	—	—	—	Y	Y	Y	Y	—	Y
Washington	—	—	—	—	—	—	—	—	—	—	Y	Y
West Virginia	—	—	—	—	—	—	—	—	—	—	—	Y
Wisconsin	—	—	—	—	Y	—	Y	Y	Y	Y	Y	Y

How to Do Business in Latin-American States

The Editor of MUNICIPAL ENGINEERING:

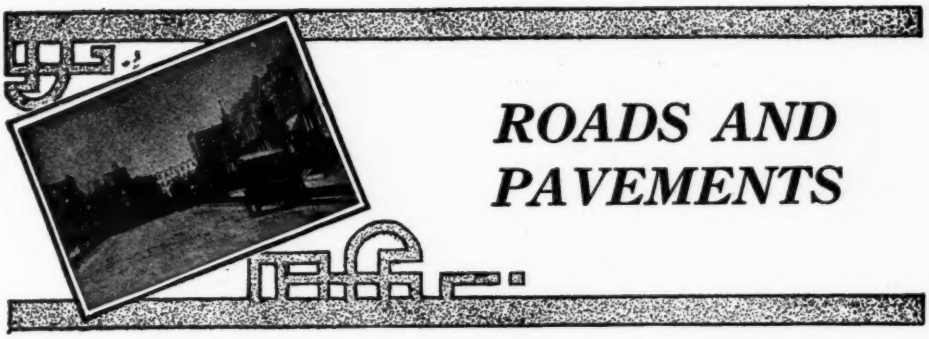
Sir—I have been making Latin America rather a study for some time, realizing that the ultimate interest of the United States would turn in that direction. The present European conflict has done more in a month to advance this interest than the ordinary course of events could have done in many years.

The trouble has been, in detail, that American merchants and the public here have never realized to what extent our Latin American neighbors have advanced. Rio de Janeiro, probably one of the most beautiful cities in the world, and one of the most modern in a quiet, dignified way, is thought of generally as a little tropical town, and not one person in ten (or even a hundred) has any idea of the size or importance of Buenos Ayres.

Thru ignorance and the underestimation of the South American markets, our merchants have only gone after the trade in the most desultory fashion. Salesmen have been sent who spoke only English and who rushed in with "Yankee" haste, trying to force an order from the customer with only one interview. This method of his does not appeal to the Latin American merchants, who make friends first and talk business afterwards. American catalogs have frequently been sent in English, and American goods, when the orders are secured, have generally been badly and wrongly packed.

Germany, however, has avoided these and many mistakes, and above all has realized the value of South American trade, hence the strong hold she has secured in every South American city.

C., New York City.



ROADS AND PAVEMENTS

Putting Paving on a Systematic Basis in New Orleans

New Orleans has just begun work under a new paving law which represents improvement and progress toward the systematizing of city paving work. The essential features of the law are that prior to the first of September the city must make its plans for all the street paving that is to be done during the succeeding calendar year; after the bids are opened they are published for a month and the property owners are given an opportunity to petition for the type of pavement that they desire. Thereafter certificates are sold against the assessments for the work and the proceeds of the sale of the certificates are used to pay the contractors.

The assessment proceedings are to be finished before the beginning of the work, thus financing the property owners' portion and doing away with the troublesome tax lien. The bonds sold in anticipation of the collection of the property owners' share of cost rest not only for their security on the fund created by the assessment, but are made by law an obligation of the city and given a specific lien against the city's reserve funds. They may be sold as low as 95, thus facilitating their prompt disposal at times when the bond market is below normal. This amounts to making up in advance a plan covering the amount of paving to be done and types of pavements to be laid, as well as the financing of a year's work.

It is provided that bids are to be taken on a great many types of pavements, for which detailed specifications are legalized. These specifications include sheet asphalt, asphaltic concrete, cement concrete, rock asphalt, mineral rubber and wood block. The bituminous specifications draw a clear distinction between "oil manufactured asphalt street pavement" and "natural pitch asphalt street pavement"; but full competition is provided between all these different types without making the attempt to cover all or any general class of materials or pavements in any one specification. No specifications are "closed," except those describing patented pavements. At the same time this law provides active competition and yet makes a distinction between products of different characteristics and varying prices, experience having shown that when blanket specifications that cover everything are attempted the city merely makes it certain that it will get the cheapest material without regard to relative values.

Repairing Concrete Pavements

In a recent paper Frank F. Rogers gives some information about the repair of concrete pavements and roads, from which the following is taken:

The oldest concrete pavement of which the writer has knowledge was built at Bellefontaine, O., in 1893 and 1894. On December 14, 1912, Mr. C. A. Inskeep, city engineer, wrote me that the approximate total cost for repairs had been $200 on 4,400 square yards. When laid the pavement was cut into squares, and the principal part of the wear has been along the longitudinal joints thus formed. Repairs have usually been made with cement mortar or concrete, which has been placed in the grooves after they have been chiseled out. Sometimes this patch has been dovetailed in—that is, the sides of the notch incline towards the axis of the groove rather than outwards. In some places paving bricks, laid crosswise, have been cemented into the prepared notch, instead of making the entire patch of concrete. This has been done when it was impracticable to keep traffic off the street long enough for a concrete patch to harden. If the reported figures are accurate, the total repair cost has been only 4.77c per square yard in eighteen years, or 0.265c per square yard per year —a repair cost which seems almost incredible.

Bad Axe, Mich., a town of 2,500 population, paved its main street with cement concrete in 1908, with gravel concrete two-course work. The contractor guaran-

teed this street for five years, and has patched a few places, by chiseling out the old pavement to the subgrade and filling the excavation with two-course concrete of the same mix used in the original construction. The transverse joints now show considerable wear, the groove, due to chipping off the edges of the adjoining slabs being, in many places, two inches deep, and very perceptible when riding over the pavement in an iron tired vehicle even at a slow speed. Similar wear is visible around the edges of some of the patches. There are also some holes which need repairing.

The pavements at Grand Ledge and Scottville were laid in 1910. Both were two-course work and were in need of some repairs the second year, mostly at the joints.

The pavements at Ann Arbor and Lansing were top dressed with tar and sand, refined tar being used on all the later work. This top dressing wears off annually, particularly in the central portion of the roadway, and has to be wholly or partially renewed at a cost of from 5 cents to 6 cents per square yard.

Kalamazoo, Mich., carefully watches the surface and all holes are repaired when they are small. The holes have been thoroly cleaned, washed with cement and filled with a 3 to 1 mixture of good bank gravel and portland cement. These repairs have given good results. The pavement shows a large number of long surface cracks with the edges wearing rapidly. The percentage of surface repaired during the first five years of life is small, but a larger percentage will have to be repaired in the next five years. Saginaw county, Mich., built its concrete road in 1910, and it has had quite extensive repairs. The portions that have been found defective were due to a leaner mix or to a less depth than was specified. Repairs have been made by cutting out the defective places to the corrected subgrade and filling with concrete. This pavement carries a rather heavy mixed traffic, consisting of heavily loaded farm and trucking wagons thruout the season, and a heavy sugar-beet traffic (loads, 2 to 5 tons) during the months of October and November on a 9-foot width. Repairs have been very small on the better built portions of this road.

On November 23, last, an inspection was made of the Woodward avenue concrete roadway, one mile of which was laid previous to July 1, 1909, and 1 1/5 miles of which was laid in the early part of the season of 1910. Both of these pieces are the two-course work above referred to. These pavements are 18 feet wide and have transverse expansion joints every 25 feet, making 211 sections to the mile. The oldest mile has had nearly four seasons' wear and has passed thru three winters. On the first mile, 9 sections show one or more pit holes, 17 sections show transverse cracks, a very few of which reach entirely across the roadway, and 61 sections show longitudinal cracks, many of which reach the whole length of the section. In fact, most of these longitudinal cracks are grouped, several contiguous sections showing cracks where there were any at all. Isolated sections showing longitudinal cracks are the exception and not the rule.

The 1 1/5 mile stretch, which has had nearly three seasons' wear and has passed thru two winters, shows defects as follows: Pit holes, 8 sections; transverse cracks, 7 sections, and longitudinal cracks, 13 sections. For better comparison, I will say that 29 per cent. of the sections showed longitudinal cracks on the first mile, while only 5 per cent. of the sections showed longitudinal cracks on the second 1 1/5 miles. Roads of more recent construction show proportionately less defects.

Laying Concrete Pavement

The Highway Commissioners of Wayne County, Michigan, have been laying concrete roadways with their own equipment, labor and supervision long enough to reduce their methods to a system which secures increasingly better results. A brief description of the principal steps in the process may lead to further study of the details of the process whereby quality of work is maintained and cost is kept low.

When the road to be improved is crossed by or is near a railroad, and switching and yard facilities can be obtained, the cars of gravel, sand, cement, etc., are unloaded in piles as they are received, the piles being located conveniently for reloading into cars, and cement being stored in a waterproof closed shed.

The commissioners own the equipment for an industrial railway with several miles of track and the first operation after the construction of a road is decided upon is the laying of this track alongside the location of the concrete roadway, the ease of changing location being such that but little grading is necessary beyond that required to give the roadway its proper gradients and foundation.

A small industrial locomotive is used to transfer cars and occasional turnouts at convenient locations make it possible for loaded trains to pass empty cars hauled by team or by men. These cars are first used in transferring earth moved in grading the roadway from cut to fill or to waste and when the work is well under way in all its stages the locomotive is kept busy hauling cars of earth and cars

of concrete material and returning empty cars.

The industrial railroad begins at the stock piles and the cars can be filled by hand or steam shovel, according to the amount of work to be done and the rapidity with which the materials are to be moved.

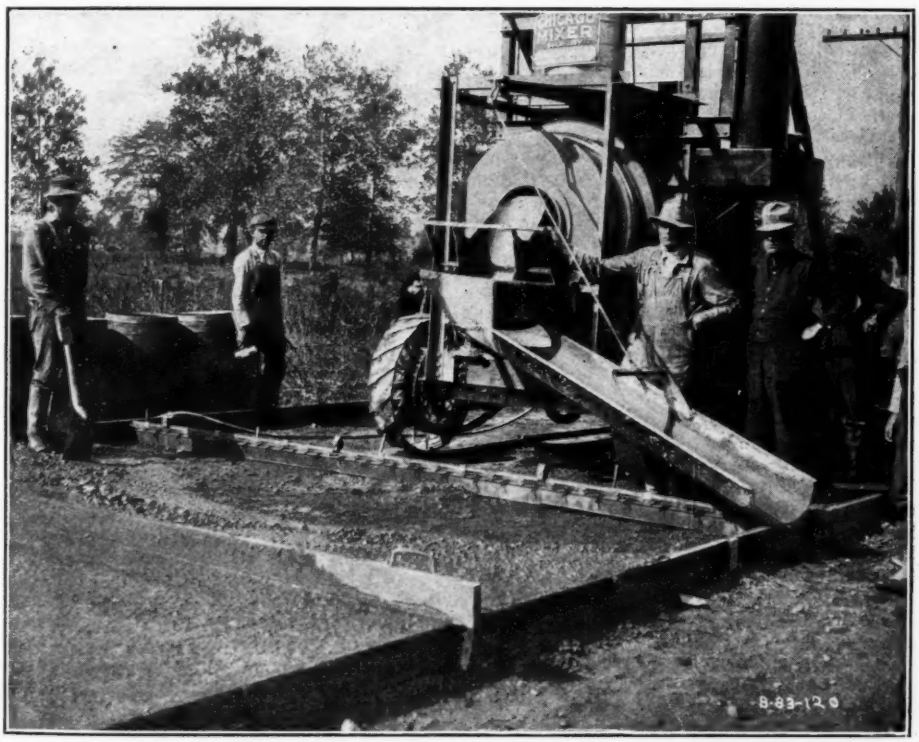
When the sub-grade of a section of the road has been properly formed and consolidated, as the local circumstances demand, the concrete mixer is set to work, a Chicago concrete mixer being shown at work in one of the accompanying photographs. That photograph shows plank form staked down, to retain the concrete until set, but the Wayne County Commissioners are using an improvement on the forms, made by the Trussed Concrete Steel Co., in the shape of a steel form made of channel bars, staked down with bent rods as shown in the second photograph.

These channel bars are jointed together by bars fitting in slots made by riveting steel strips to the webs of the channels, as shown in the photographs, and are therefore continuous at the same time that the individual bars are easily removable as soon as the concrete has set, and can then be carried forward to extend the forms. There is flexibility enough in the system of bars to make their alinement easy and certain, and stiffness enough, when they are staked down, to withstand the pressure of the concrete while being placed. Concrete is deposited wet enough so that it requires no tamping.

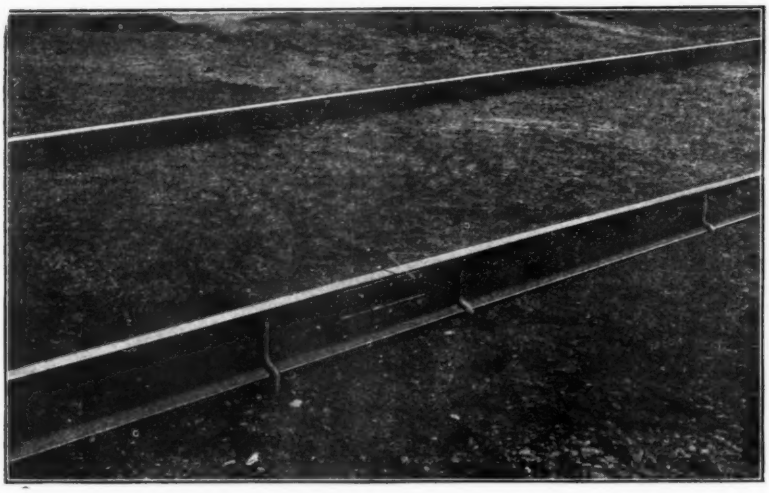
The concrete mixer is self-propelling, and, when a section of the road reachable by the trough or telescoping tube used in distributing the concrete has been covered, it moves itself forward a few feet on planks laid for the wheels to run upon.

The preparation and placing of the expansion joints is an interesting operation. On one road, whose construction was observed by the writer, the protecting plates were thin, soft steel plates with short parallel slits cut in them in pairs a few inches apart, devised by the Trussed Concrete Steel Co. These plates were delivered along the road together with the strips of compressible asphalted felt filler.

One man prepared these joint protectors for the use of the concreting gang. Laying a plate flat on the ground, he broke one end of each strip between slits free from the plate by blows with a pick of the right width to fit the resulting slot.



LAYING CONCRETE PAVEMENT *in Wayne County, Michigan. Placing expansion joints and laying and surfacing concrete. Wooden forms used.*



LAYING CONCRETE PAVEMENTS *in Wayne County, Michigan. Modern steel continuous forms movable in sections.*

Turning the plate over, he first bent the tongues thus formed back, and then with a bar having a notch of the right size, bent and twisted the tongue so that it projected at right angles to the plate and had a quarter turn of a twist in it. Two of these plates being prepared, they were put together, back to back, with the strips of asphalted felt between them, and they are then clamped together by means of a frame with a number of short rods fitted with eccentrically mounted circular cams which, when turned, grip the plates firmly along the upper edge. The plates are curved to fit the crown of the roadway and when thus held together are ready for placing in position for the concreting, as shown in the first of the accompanying photographs. The frame spoken of is somewhat stiffer and more elaborate than the simple clamps seen in the photograph and the placing and keeping in place of the joint protector is more accurate and certain. The clamps are loosened and the clamps and frame are removed as the concrete is laid on the farther side of the joint. The plates of the joint protector are carefully placed so that their top edges are a small fraction of an inch below the level of the finished concrete and can then be depended upon to wear evenly with the concrete, and thus prevent the formation of breaks or holes alongside themselves.

After the concrete is set sufficiently it is covered with sand or earth, which should be kept moist until the concrete has been thoroly cured.

Usually water is supplied along the work for moistening the foundation just ahead of the concrete, for the mixer and for wetting the covering of the concrete, by means of a pipe laid alongside the road from a convenient source of water supply, thru which it is pumped by a gasoline pump at pressure sufficient for the uses made of it. Sometimes several thousand feet of the water pipe are in use at once, but usually a few hundred feet are all that are necessary.

Slag For Road Paving

In London experiments have been made in the use of tar slag macadam in several streets, and the following is a report of the results as observed thus far:

In St. Marylebone the material was laid in two coats and rolled, the surface being covered with fine granite chippings, and the total thickness when finished being 4½ inches. The price varied from 4s. to 4s. 8d. ($1 to $1.15) per yard super, and the paving is said to be wearing well.

The New Eltham and Sidcup road, trial length, was laid down in July, 1911, by the Kent County Council by arrangement with the road board. The material used was blast furnace slag ranging from 2¼ inches down to ¾ of an inch. When laid in one coat of mixed gages, the proportions are about 60 per cent. ranging from 2¼ inches down to 1¼ inches, 30 per cent. from 1¼ inches down to ¾ inch, 10 per cent. from ¾ inch down to ½ inch. The binder used is distilled tar, without any admixture of other material, and after first setting it is not affected by normal changes of temperature. The cost per yard super. was 3s. 3d. as paid to contractors, and the paving has stood well and is said to be satisfac-

tory. Another section, 794½ super. yards, on the same road, laid with the same material, is also satisfactorily reported upon. The road board says:

"This section is quite good, and shows comparatively little wear. The roadway on both sides of this section is properly curbed and channeled, and has properly constructed footpaths. These abutments give considerable support to the material forming the carriageway, preventing lateral thrust, and enabling better initial consolidation."

In the boro of Wandsworth, on the Portsmouth road, trial lengths were laid for the express purpose of making comparisons between the rates of wear of previously treated tarred granite when compared with similarly treated tarred slag macadam. A section of the latter—1,629.16 super. yards—was completed in August, 1911, coated slag being spread in two layers, first layer graded from 2½ inches down to 1½ inches., second layer from 1½ inches to ½ inch, surface finished with fine chippings. The cost per yard super. was 4s. ($1). The condition of this section is said to be good, and the surface wearing uniformly.

The New York State Highway Commission last year laid some sample slag pavements, some report of which is made by Division Engineer F. S. Strong in the official organ of the commission, from which the following is derived:

The types in which the use of slag is allowed include plain concrete pavements, concrete pavements with bituminous surfacing, Hassam concrete pavements, water-bound slag macadam with and without glutrin, some with limestone screenings and some with slag screenings, and bituminous-bound slag macadam highways. Much of this work is now under contract, and a considerable portion of it will be completed this year. The material is also being used to some little extent as a surfacing material in the repairing of old macadam pavements.

It is believed that the careful and continuous future inspection of the highways built of slag will produce valuable information and statistics of its merits as a road metal.

A big bulk of the slag available in the section of the state referred to consists of blast furnace slag. However, in the further reduction of pig iron in the production of steel, various processes are used, as, for instance, in the open-hearth furnace, where the crude metal is further purified, here again a flux is used which rises to the surface of the molten mass as slag. Slag formed in this operation has been used but very little on account of the small quantities available for highway purposes, altho it possesses many desirable qualities, such as hardness, toughness and excellent cementing qualities.

In the vicinity of Youngstown, Ohio, in 1909, the office of public roads, in cooperation with the Carnegie Steel Company, conducted a series of experiments to determine the best method of utilizing this slag for road construction. In the experiments at this place, the blast furnace slag was taken from a bank that had aged about two years, the material of which came from six blast furnaces of the same type. A stea mshovel was used to load the slag from the bank into large gondola cars. These cars were drawn to a gravity screen, where the slag was dumped into a chute and passed over the screen to separate into proper sizes. After passing over this screen, it was taken by rail to a site about 1½ miles from the road upon which it was to be used, unloaded and hauled to the road.

These experiments, as shown by the bulletins issued by the office of public roads, proved very interesting, and demonstrate that there is a field for blast furnace slag in the construction of highways, and the results were so favorable that the various counties and the State Highway Department of Ohio have adopted standard specifications for the use of this material. Various reports of inspections made of these roads show that they have stood up well, and, owing to the cheapness in the first cost of this material and the lightness in weight, the investment in a slag furnace macadam pavement from an economic standpoint would seem to compare favorably with that of a stone macadam pavement.

Since the completion of these experiments, which were conducted with slag which was not run thru a crusher, but was taken directly from bank and screened, slag pavements have been constructed from commercial blast furnace slag, the slag being carefully sorted to obtain the best materials and run thru a regular stone crusher in order to obtain the proper sizes for use in the various courses of macadam, resulting in superior types of construction and more uniform and lasting types of pavements.

In the vicinity of Buffalo, where there are many large blast furnaces, this slag has been used to some little extent for highway work, altho no intelligent effort was made to obtain a high-class construction, due to the lack of available money for said purposes in the localities where the work was done. Yet this material is found to consolidate under traffic without rolling, harden and smooth out, making an excellent country road. Where incisions were made in some of these roads for various purposes, it was found almost as difficult to cut thru this material as to

cut thru a concrete foundation for brick pavement.

At the beginning of 1913 a plant was established in connection with the Buffalo Union Iron Furnace to take over the slag product of these blast furnaces and produce therefrom a commercial product to be known as crushed screened slag for railroad ballasting and highway surfacing purposes. During the season of 1913 a considerable amount of this material was used on town highways, and reports received from various town and county superintendents in districts where this material was used stated that satisfactory results were obtained, altho thus far it is too early to reach any conclusion as to the definite wearing qualities of this material.

In reference to the use of slag product in the open-hearth process in the manufacture of steel, perhaps some of the most successful work of this kind in the construction of streets or highways is that which has been done in the city of Cortland. In this city the first slag street was constructed ten years ago as a water-bound macadam highway, and, according to the city authorities, has given excellent results ever since. They also have other water-bound slag roads which have been built eight years with practically no repairs of any nature. During the last four or five years the city authorities have used a bituminous or asphaltic binder in the construction of the slag streets, using the penetration method with excellent results. The slag after being cooled is crushed in an ordinary stone crusher, the larger pieces being used in the bottom course, which is bound with loam. For the body of the top course, a slag varying in sizes from ¾ inch up to 2 inches is used. This top course has a finished depth of 3 inches, and is bound with a gallon to a gallon and a half of asphaltic binder to the square yard; is then filled with slag screenings and rolled. These streets have also the appearance of sheet asphalt pavements and are standing up well under fairly heavy traffic.

Calcium Chloride in Road Maintenance.

The use of deliquescent salts in maintaining road surfaces has been studied very thoroly by S. G. Howe, of Detroit, Mich., and he has devised methods of using them for various materials and classes of traffic which produce the best results attainable, and suitable for conditions too strenuous for the ordinary earth or gravel road and not heavy enough to demand expensive hard or pavement surfaces.

One method offered is the use of "rubber-stone," a mixture of fine crushed stone material with deliquescent salts, chlorides of calcium and magnesium, a 40 per cent. solution of the chemicals being used in making the mixture.

According to Mr. Howe, rubber-stone is or may be made of a cheap, soft stone, either sand or limestone, a soft, porous stone acting as a carrier and retainer of the chemical; also a low-grade clay containing gravel, as well as properly crushed soft slag or clean steam furnace cinders. All of these substances are cheap, many of them in some parts of the country are a useless waste, so that, with a low-priced chemical to give the binder, the result is a cheap road material. There is hardly a county or township in the country which does not make or contain one of these substances within its borders, so that the expense of team or rail haul and freight rates ought to be light.

If the road dries out, which it is not likely to do very often, the condition is that of a stone macadam or concrete road, but if the rubber-stone is laid of proper thickness there is little likelihood of this condition. Even if the surface becomes dry, capillary action will bring moisture from below to maintain an even packed condition on the road.

In these combinations, the stone mixture should be from dust to three-fourths or one-inch size, the dust and fine stone being the carrier of the chemical, the coarser stone giving the body to the road. Coarser stone is better for a base, but for the surfacing material the coarser stone should be kept out. With gravel, the clay is the chemical carrier. For surfacing work, stone above 1½ inches in size should be screened or raked out and used as a filling for low or soft places in the road. For rut-patching, run of bank gravel may be used, the coarser stone acting as an anchor to the finer stuff. Where a slag is used, the conditions should be the same as with crushed stone; and here the finer stuff is used as a chemical carrier. With cinders it is not essential to crush the larger pieces, as the traffic over the road in the packing will generally reduce them enough. These materials are preferable in the order named, but a good road of this class may be made of any of them.

The essential requirements made by Mr. Howe are a proper quality and quantity of chemical thoroly incorporated; a proper thickness of the rubber-stone on the road top, preferably a 5-inch loose spread, which will pack to about four inches; a proper nursing or spreading of the material on the road as it is being packed, traffic not being shut off; keeping a man on the road with a rake or scraper to fill in the wheel marks until the road is hard and smooth; and proper drainage.

This chemical will not take or hold water enough to become muddy if the surplus water is allowed to run off, but good drainage is required on any kind of road or pavement if service is expected.

Any good, firm earth will answer for a foundation, low or soft spots being filled with cinders or stone of any kind.

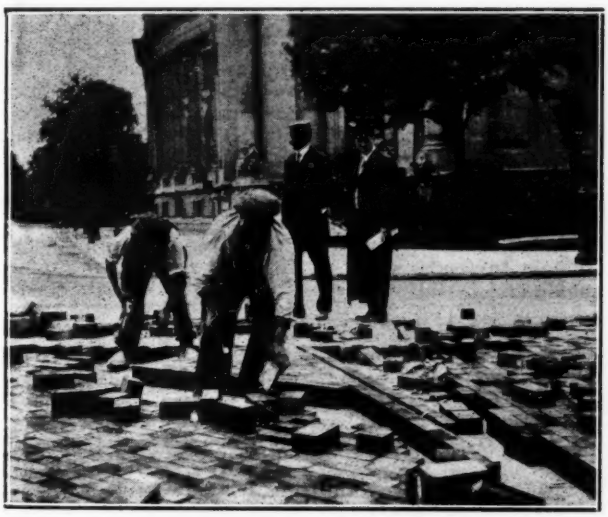
Mr. Howe concedes "that the so-called scientific theories regarding these deliquescent salts have been against a long life for them under exposed conditions, but my five years of actual experience with them under very trying conditions have disproved all their theories." He shows 4½ years' success with gravel on a piece of road at Bloomfield Hills, near Pontiac, Mich., and the same with a piece of road at the Detroit Copper and Brass Works, where they haul 5-ton loads of copper over it every day, and it is apparently in as good condition today as when it was fixed up.

A cheaper construction simply grades the ordinary earth or sand road, loosens up 3 or 4 inches depth with disk harrow or spike-tooth drag, and fills the loosened earth with a 30 per cent. solution of Del. Q. salt. The sprinkling cart is set for half discharge and the road is given about four sprayings and mixings with harrow. About 6,000 gallons of the salt solution are required for 20,000 square yards of road surface.

For dust laying the road can be sprinkled with the salt solution at such intervals as may be required.

No adequate idea of the cost can be given without knowledge of the cost of the materials locally, but roughly speaking it may be said that the rubber-stone method will probably cost between 50 and 95 cents a square yard, the filled road 20 to 25 cents and the sprinkling 1½ to 2½ cents a square yard. One method of computing the cost of the dust-laying treatment of earth roads makes the cost 3 cents a foot front per year for the first three years, when the road will be in condition to skip the treatment for two years.

Mr. Howe is patenting his combinations and methods, but is very liberal in his permissions to use them provided he can insure success by supplying the chemicals required, on which success very largely depends.



WOOD BLOCK PAVING IN PARIS. *Laying five-inch Swedish pine blocks on Cours la Reine, illustrating the expansion joint.*

Removal of Wood Block Troubles in Europe

In a recent paper describing his observations of wood block pavements in Europe, S. R. Church stated that European wood pavements do not bleed, expand or buckle, and are not slippery. He inquired briefly into the reasons to see what we have to learn from their methods. His conclusions follow:

Conditions are so entirely different that I do not see how any direct comparison can be made. In the first place, as to slipperiness, I have already explained that the non-slipperiness of their pavements is due to the use of softer wood. As to bleeding, they seldom have any weather in London hot enough to cause bleeding. In Paris there is not enough oil in the blocks to cause bleeding. The climate also undoubtedly plays a very important part in the question of expansion and contraction. It is agreed that the sudden expansion that sometimes takes place in our wood pavements is due to a rapid absorption of moisture, usually after the pavements have been unduly dry. This can hardly occur in England, where they have a little rain all the time, very seldom any torrential downpours or any long-continued dry spells. The average humidity is high. It is a question whether the pavements ever get dried out to anything like the extent that ours do. I should say that generally the blocks are in a maxi-

PARIS WOOD BLOCK PAVING. *Applying cement and sand grout to surface of completed pavement in Cours la Reine.*

mum condition of expansion. The same must be true in Paris, or the inadequately treated blocks in that city would certainly bulge. On the other hand, it is well worth considering if the kind of wood that they use has something to do with the lack of expansion troubles. It is manifestly a very different wood from our long-leaf yellow pine. As I have already stated, it does not present as attractive an appearance, and it is probably not so durable. It may be, however, that with short-leaf pine or tamarack or Douglas fir we could obtain results more nearly approaching the European results by following their practice more closely with regard to treatment and methods of laying.

I believe we can afford to give careful consideration to the question of lighter treatment, but I do not believe that because ten or twelve pounds is ample in London with the wood they are using and the climate that exists, it would be ample for our woods in our climate.

The points that I would especially emphasize for your consideration are:

1. The great care used in the preparation of the concrete foundation, and, in fact, in the whole workmanship of the pavement.
2. The general use of deeper blocks.
3. The universal practice (in England) of sealing the joints of the pavement with coal tar pitch, so as to prevent the entrance of moisture.

I would also emphasize that the pavements in Europe (this does not apply only to wood) are laid and maintained by workmen who have more conscience, or at least take greater pride in their work than we find on the average job in our country. There is less inspection on the part of the city of the operations of making the blocks and laying them, but I got a very strong impression that the manufacturers are taking no chances of having their material condemned on account of carelessness or bad workmanship.

In conclusion I want to repeat that in my judgment none of the European wood paving surpasses our best wood streets in appearance.

Street Paving in Des Moines, Iowa

The total length of paved streets in Des Moines is 101 miles, divided as follows: Brick, 58 miles; asphalt, 34 miles; creosoted wood block 3 miles; concrete, 3.5 miles; bitulithic, 1.5 miles; macadam, etc., 1 mile.

The total area is 1,950,000 square yards.

The first pavements, laid in 1882, were the untreated round cedar blocks. These have long since been replaced by more durable material. Brick has always been favorably regarded, Des Moines being an important producer of this material. Asphalt has been extensively used for the last ten years, especially on residence streets. During the last year or two bitulithic has entered the competition against asphalt. Creosoted blocks have been considerably used on business streets. Concrete, altho hardly out of the experimental stage, is expected to prove valuable for residence streets and roads leading into the country.

Work on pavements has been especially active during the past four years. In that time the average per year has been nearly ten miles, of which about two miles each year was renewal of worn-out pavements.

The width of the roadways for business streets is made as great as the total width of the streets will permit, a 42-foot roadway being used for a 66-foot street. For residence streets with double track street railway the roadway is 34 to 36 feet; with one track, 30 feet; and with no track from 22 to 26 feet.

The City Railway Company pays for 7 feet width of pavement for each track, extending along paved streets, the remainder is assessed against abutting property, the limit of assessment being

25 per cent. of the assessed valuation of the property.

The present tendency in paving is to extend pavements on main highways to the city limits, there to meet improved roads built by the county. Two such streets have already been paved with brick, the city and property owners dividing the expense, and some preliminary work has been done toward paving several others with concrete.

Especial attention is now being given to the establishment of suitable street grades before paving. In a number of cases old grades have been materially changed, and new alinements worked out for crooked streets, with the idea that any temporary inconvenience occasioned by such changes are more than offset by future benefits resulting from improved traffic conditions.

Division of Roads For Traffic

By Francis Wood, Boro Engineer and Surveyor, Fulham, England.

With reference to the method of classification of roads, any census of traffic that is taken is usually divided by the width of the road, but a road may be very wide and the traffic confine itself to about 12 feet in the center of its width, this portion of the roadway wearing rapidly, whereas the remainder is scarcely affected. To divide the traffic on such a road over its full width would give a deceptive indication of the real unit of traffic per foot of width. I therefore suggest that where there is only one line of traffic, whatever the width of the road, the effective width should be taken at 12 feet; where there are two lines of traffic, 20 feet should be the width, and with four lines of traffic, 30 feet should be the width, whatever the actual width may be.

Then the roads should be included or denominated, according to the unit of traffic, the horsed traffic being kept separate from the motor traffic:

Thus, if a road has 100 tons per foot width of roadway per day, made up of 30 tons heavy motor traffic, 20 tons light motor traffic, 25 tons 2-horse traffic and 25 tons 1-horse traffic, the road would come under the letters B-G-S-X, *i. e.*, Heavy and Light Motor Traffic Class II, and 2-horse and 1-horse Traffic Class III, and without trouble the comparison would easily be made with any other census of traffic.

Division of Roads for Traffic.—With reference to the laying out of new roads, the method of dividing the road up into three parts, the two side divisions being allocated to slow-moving traffic while the center one is confined to fast-moving traffic, has much to be said in its favor, but its applicability is confined to the design of new towns on account of the cost of land; there is also another feature which has to be considered, and that is the effect of such a road on the land adjoining it. A narrow road is considered to be advantageous to a shopping center, because the shops are brought into the view of the passenger traffic on both sides of the road, whereas the wide road has the opposite effect, *i. e.*, of confining the shops to one side of the road, and of rendering the other side derelict.

Duplicate Roads.—In this case it may prove to be a desirable method, instead of having very wide roads, to provide one or two parallel roads, and in this way divide the slow from the fast traffic. But to lay down definite lines is not a policy that should be advocated without careful inquiry into the requirements of the districts thru which the traffic passes, as in every town there may be peculiar difficulties which militate against such a proposal.

Subways at Dangerous Crossings.—Then there are the areas where traffic concentrates and makes it difficult for passengers to make a crossing. In many such cases it has been considered necessary to construct subways, but these subways are constructed so as to disturb in the least possible manner the existing

Class of Road	Motor Traffic				Horse Traffic.					
	Heavy		Light		4-horse		2-horse		1-horse	
	Tons per foot width		Tons per foot width		Tons per foot width		Tons per foot width		Tons per foot width	
I.....	1 to 20	A	1 to 10	F	1 to 10	L	1 to 10	Q	1 to 10	V
II.....	20 to 40	B	10 to 20	G	10 to 20	M	10 to 20	R	10 to 20	W
III.....	40 to 60	C	20 to 30	H	20 to 30	N	20 to 30	S	20 to 30	X
IV.....	60 to 80	D	30 to 40	J	30 to 40	O	30 to 40	T	30 to 40	Y
V.....	80 to 100	E	40 to 50	K	40 to 50	P	40 to 50	U	40 to 50	Z

conditions, with the result that the subway, instead of being a benefit, has been a waste of money, as the public finds them inconvenient and difficult to use by reason of the steps down and up at the entrance and exit. Instead of being as shallow as possible, *i. e.*, below the surface of the road, they are placed very often at too great a distance below the surface. If a subway is necessary—a bridge is practically an impossibility on account of the height it must be over the roadway—then the public should be put to the least inconvenience possible, and encouraged to use the subway. The roadway would be effectively widened by the substitution of the subway for the surface crossing, and to narrow the actual width of the roadway would cause no great inconvenience to the vehicular traffic, therefore, this area could be added to the subway and footway. Where the subway has to be constructed, the writer suggests that if any inconvenience has to be caused to the traffic, it should be to the vehicular traffic rather than to the passenger traffic; naturally, however, some of the inconvenience must be given to the passenger traffic, but as their safety would be assured by the avoidance of danger, they would not complain.

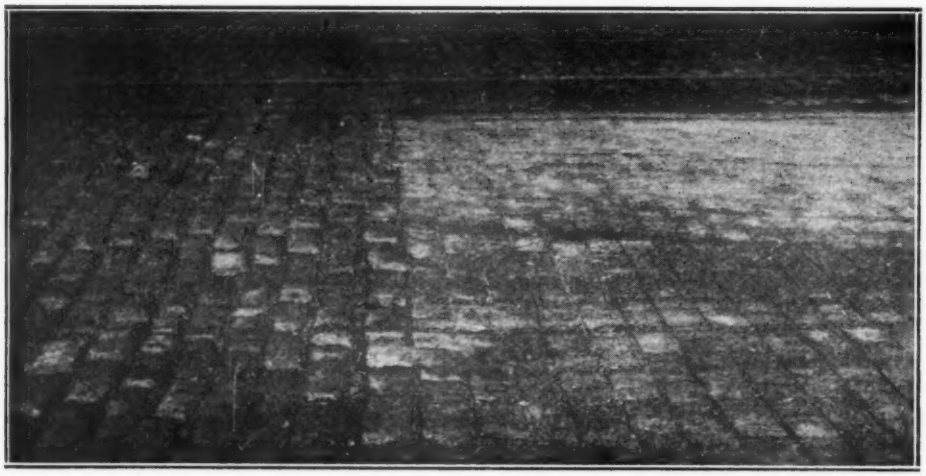
The roadway should therefore be raised a proportion of the height that is necessary for the subway to be below the surface; with modern methods this would be probably confined to about 8 feet 6 inches, and, instead of slopes, an easy gradient should be made at the entrance and exit on either side. Suppose the buildings on either side of the street were 60 feet apart, and the subway extended 40 feet on either side, the total length of the subway would be 120 feet. The roadway could be increased in height 3 feet, and the subway would be 5 feet 6 inches below the original surface of the road, and the slopes for passengers could be at the rate of 1 in 16, or thereabouts. The footway would be 7 feet wide and about 5 feet would be given to the subway, this would leave a 36-foot roadway. Where the roads had already a slope there would be a difficulty in carrying out such a proposal, but doubtless a modification could be devised which would be an improvement on the present system. The cost of such a proposal would be very considerable, but having regard to the fact that the construction is of a permanent character, and is to be for the benefit of a great number of people, the cost may be regarded as somewhat of a secondary consideration, as it is impossible to calculate the value of the benefits which the public would derive from it.

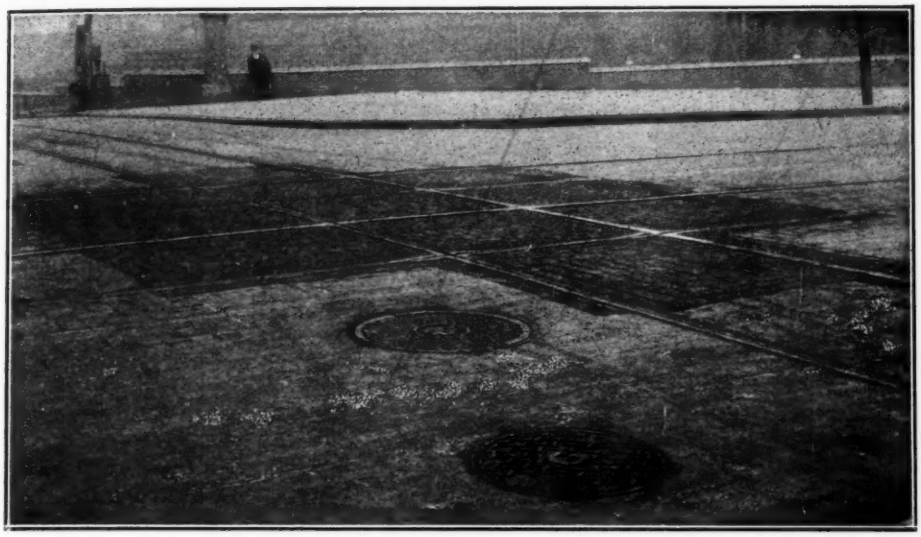
DIFFERENCE BETWEEN *old granite block and modern dressed granite block pavement on Market street, Philadelphia, Pa.*

Recent Granite Block Pavements in Philadelphia

Market street in Philadelphia, was repaved in 1913 from the end of Schuylkill river bridge to Lancaster avenue. The traffic on the street is very heavy and it was paved with granite blocks which were very old and had worn until the pavement was very rough.

The street was repaved with the most modern type of dressed granite block pavement conforming to the best modern standards for this class of work. The new type of granite block forms a pavement almost as smooth and easily cleaned





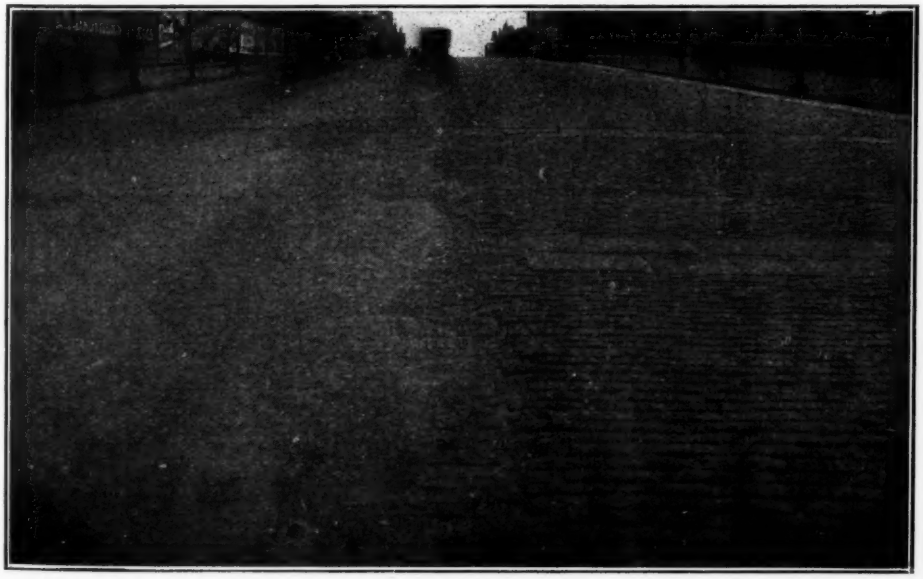
as asphalt and yet sufficiently durable to withstand the wear of heavy traffic.

The new pavement has a 6-inch concrete base and a 2-inch sand cushion. The close-fitting granite blocks with dressed heads are 5 to 5½ inches in depth, 3½ to 4½ inches wide on top and 8 to 12 inches long.

Such pavements on completed contracts have cost $3.76 a square yard, and contracts were let for construction in 1914 at $3.91 a square yard for paving and $4.20 for repaving. One contract completed in 1914 was let as low as $3.40 a square yard.

ABOVE: *Modern dressed granite block used in street railway crossings on streets paved with wood blocks.* BELOW: *Difference between old granite block and split redressed granite block on Broad Street near Lehigh Avenue, Philadelphia, Pa.*

In the business section of the city these modern dressed granite blocks have been substituted in the intersections of street railway tracks for wood blocks in the wood block pavements at intersections on Market and Arch streets. The street rail-



way tracks are laid on the ordinary subsoil on the bed of the street, which results in so much vibration of the rails that the pavements thruout the city are suffering to a very great extent. The wood block in these intersections seldom lasts over six months. Possibly the granite blocks will not be very much more durable, as it is apparently impossible to hold any pavement down under such conditions.

One of the accompanying photographs shows the difference between the old granite block pavement and the new, modern dressed block on Market street. Another shows the granite blocks in a street railway intersection on a wood paved street. A third shows the difference between an old granite block street and relaying with split and redressed blocks, being two halves of the same roadway.

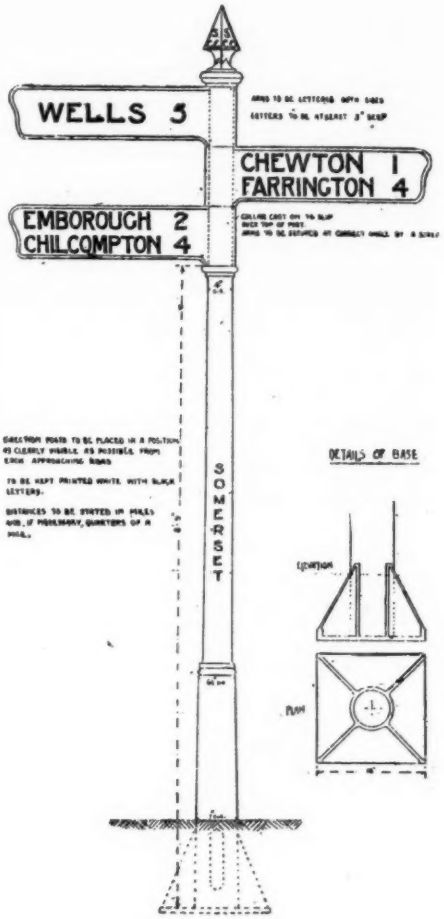
Increase in Use of Concrete Pavements

The accompanying diagram shows the increase in the use of concrete in road and street pavements in the past five years. The figure for 1914 is, of course, an estimate, but is believed to be less rather than more than the actual amount constructed.

Guide Post In England

The accompanying drawing, reproduced from *The Surveyor and Municipal Engineer* of London, shows a post designed by H. T. Chapman, the county surveyor of Somerset. The post is of half-inch metal, the base 6¾ inches in diameter at top and 7 inches at the ground level. The main riser of the post is 4 inches in diameter. The cast iron base is 18 inches square and is buried about 15 inches in the ground. It can be bolted to a concrete foundation if desired and the lower section of the post is set in a braced cylinder rising from the base plate. About 8 feet above the base the post has a collar, which fixes the location of the road signs.

These direction plates are of cast iron, each with collar to slip over the top of the post and they are fastened in by an ornamental finial with a collar. As many



direction plates can be used as there are roads, the length of the post being chosen to suit the location. The letters are intended to be at least 3 inches deep, but vary according to the number of towns to put on and the lengths of the names. Mileage to turns is given in even miles and, if necessary, quarters. The names are cast on the plates and letters are painted black, post and plates being painted white. Letters are put on both sides of plates so that they can be read from either direction. The plates are fastened in place to point in the directions required by means of screws. The name of the county is cast on the post itself.

Posts are placed in position to be as clearly visible as possible from each approaching road.

SANITATION

The Sampling of Sewage

By G. Bertram Kershaw before the Annual Congress of the Royal Sanitary Institute at Blackpool, England.

A very usual object for which samples of sewage and various other liquids are taken is to ascertain the chemical or bacterial quality of the liquid sampled, and thereby to determine the degree of efficiency with which a particular plant is performing its functions; as, for example, the purification effected on a particular sewage by tank treatment and percolating filters. Again, samples may be taken simply with a view to finding out whether the quality of the liquid produced complies with a particular standard.

In the former case, in order to be in a position to judge of the efficiency of the plant, it is necessary to know the strength and character of the sewage as well as the quality of the effluent. In the latter case this is unnecessary, the sample either passing or failing to pass a given standard.

It is of the highest importance that the sample analyzed shall be duly representative of the bulk of liquid from which it is taken, otherwise erroneous deductions may be drawn. Inasmuch as quantitative analyses are necessarily somewhat costly, and gaging arrangements often involve a good deal of trouble and expense, it is very advisable, on these grounds alone, that the sample or samples drawn shall be as nearly representative as possible.

Nearly all waste liquids, especially those resulting from industrial processes, vary, not only in character but also in volume, from minute to minute, from hour to hour, and from day to day. Sewages, moreover, may also vary seasonally by reason of the influx of subsoil water and other factors; they vary markedly when heavy rainfall occurs.

If it is desired to ascertain the quality of a particular liquid at any given time, a single sample (termed a "chance" sample) will often suffice for the special or casual purpose for which it is taken. If, on the other hand, the character and strength of the liquid as a whole is what is to be determined average samples will be essential—that is to say, samples drawn according to the rate of flow of the liquid over at least four days.

It will be obvious in the case of sewage liquors, which in dry weather vary in strength roughly according to the rate of flow, that if the hourly proportional flows for five consecutive hours are 10,000, 30,000, 50,000, 60,000 and 20,000 gallons then samples merely drawn in equal quantities every hour will not represent the average strength of the liquid for the five-hour period unless the sewage is hourly of constant strength; whereas, if the samples are drawn hourly according to the rate of flow in quantities of, say, 100 c.c., 300 c.c., 500 c.c., 600 c.c., and 200 c.c., and mixed together, an average sample closely approximating to the truth will result. It follows, therefore, that in sampling for average strength the hourly rate of flow of the sewage must be ascertained; in other words, the flow must be gaged continuously while sampling is in progress.

Average samples of sewage liquors were taken as long ago as 1872 by the committee of the British Association at the Romford sewage farm, and probably long before that date, for liquors other than sewage. Average samples of sewage liquors have also systematically been taken by the Sewage Disposal Commission appointed in 1898, and it may be of interest to describe the method of taking average samples of sewage from start to finish.

The first preliminary to be settled is the duration of the period over which the samples are to be taken. In the majority of cases, four sets of twenty-four hours average samples, commencing Monday morning and ending Friday morning, will give a good idea of the character and strength of the sewage. In the case, however, of a large town, sets of average samples extending over seven days, repeated at different seasons of the year, may be necessary. In the case of domestic sewages from small communities, the first four or five days of the week usually constitute a sufficient period to provide data upon which, say, works could be designed, the

omission of sampling the Saturday and Sunday sewage, which is often weaker than normal on these particular days, provides a certain factor of safety.

It is always desirable to draw average samples of sewage in dry weather, and hence it is necessary to determine what shall be regarded as dry-weather sewage flow.

¶ THE EFFECT OF RAINFALL *upon dilution of sewage must be carefully provided for in collection of samples.*

The extent to which rainfall will affect the sewage flow will depend very largely upon local conditions, such as the nature of the sewerage system, the character and gradients of the surfaces of the drainage area contributing to the sewers, together with many other factors; but it depends, other things being equal, chiefly upon the intensity of the rainfall. For example, a rainfall of .05 inch, or even more, following dry weather, and spread evenly over several hours, may produce little or no appreciable effect upon the flow of sewage, certainly not sufficient to put a stop to the taking of samples; but the question of continuing or abandoning drawing of samples must be left to the discretion of the sampler, who will generally be able to gain some idea from the sewage works manager as to whether or not the sewage flow is being materially affected by rainfall.

If two or three days precede the sampling operations, so much the better; but it is impossible to predict seven to ten consecutive days of dry weather in this country.

Since an automatic height recorder in connection with the gaging operations is advisable whenever it can be obtained, it is a good plan to fix a weir and run the recorder for seven to ten days before actually commencing sampling, thus obtaining a series of charts showing the general run of the sewage flow; comparison with these charts when rainfall occurs will generally show when it is inadvisable to continue sampling for the time being.

With regard to rainfall records, at most sewage works of any size a rain gage is kept on the works, but if there is not one in use, a 5-inch gage is easily erected, and records should be taken at 9 a. m. daily during the sampling. If a rain gage is to be found in the town itself, daily records should be obtained from this source also, as it by no means follows that the rainfall in the town and on the works will be identical.

Now, as regards the apparatus required for taking twenty-four hours average samples of crude sewage, about thirty, or, better still, thirty-six wide-mouthed, glass-stoppered bottles will be needed for chemical analysis; the use of the extra bottles (apart from chance of breakage) will be apparent later.

¶ THE APPARATUS *for taking samples is simple but there must be plenty and it must be carefully manufactured and prepared for use.*

If samples for bacterial analysis are needed, a few small glass-stoppered sterilized bottles will also be wanted; these will generally be sent ready sterilized direct from the laboratory, and one or two of such bottles can be filled from the large mixing bottle when the twenty-four hours' average sample is made up. The stoppers of all the bottles, both chemical and bacterial, should be carefully ground in with fine emery, and the foot of each stopper rounded to avoid shutting in air bubbles.

As regards capacity, the larger bottles should hold about 600-700 c.c. each, and the sterilized bottles about 50 c.c. each. A large glass mixing bottle, holding about 1½ gallons, will be wanted for making up the average sample from the twenty-four separate hourly samples, and also a couple of thick glass stirring rods, and a measuring glass graduated in cubic centimeters; two thermometers, grease chalk, two or three drying cloths, and some adhesive labels complete the outfit. The bottles used for holding the mixed twenty-four hours' average sample are generally half-winchesters, holding about 1,300-1,400 c.c. each; but for special purposes a winchester is sometimes required.

Turning to the gaging outfit required: The method of gaging employed will depend upon local conditions. Whenever practicable, a wooden dam, with a brass or gunmetal rectangular weir plate screwed to the face of it, is the simplest method, the whole of the flow to be gaged passing over the weir, and the depth of liquid over the weir still being registered continuously by an automatic height recorder. "Plastic," or a mixture of clay and boiled linseed oil, is useful for making watertight joints between the margins of the wooden dam and the channel walls.

It may be well to point out here that to avoid complications in the formula for discharge, owing to the existence of material velocity of approach, one or two points need to be kept in mind.

1. The width of the weir should not exceed about one-third the width of the channel in which it is placed.

2. The transverse sectional area of the liquid falling over the weir should not

exceed about one-fifth of the transverse sectional area of the liquid in the channel immediately above the weir.

3. The weir and dam board should be perfectly upright, and have a free overfall and air space underneath the falling sheet of water, while the float of the automatic recorder should be placed sufficiently far back from the weir to avoid curvature of surface.

¶ THE RECORDER *of the flow of water over the weir in the sewer is an important part of the apparatus.*

As to the type of recorder, I have always used a small portable Glenfield and Kennedy machine, the drum being driven by a seven-day clock, and the pen actuated by the up and down movement of the float. There are, however, several automatic height recorders on the market, some of them with pen or pencil cams cut to give the discharge direct upon the chart. It is not, however, a difficult matter for any engineer to construct a simple and reliable machine for comparatively little outlay. Care is required in adjusting the pen to zero on the chart, which should be carefully pressed down to the rim at the foot of the drum.

Most recorder pens have an up and down range of 6 inches, so that the depth over the weir must be limited to about 6 inches, unless the minimum early morning flow exceeds, say, 1½ inches depth over the weir, in which case the recorder can be made to register up to 7½ inches by setting the pen at zero on the chart when exactly 1½ inches of liquid is passing over the weir, the chart base line thus reading 1½ inches above sill level. The recorder should be set up perfectly level, and the float, if in an exposed situation, should be surrounded by a cylinder of fine perforated zinc, to eliminate wind action, otherwise oscillation of the float will soon exhaust the ink in the pen, besides blurring the chart. It may be mentioned that a mixture of glycerine and cochineal, or any aniline dye, makes a good ink for a recorder pen.

Having erected the weir and recorder, the sample bottles should be prepared and the time for commencing settled. Assuming 9 a. m. to be the hour determined upon, and that average samples of crude sewage are to be taken, the recorder should be started at 9 a. m., and the first sample of sewage taken at 9:30 a. m., the second at 10:30 a. m., and so on hourly until 8:30 a. m., the following morning, when the first set of twenty-four hourly samples will be complete. The filling of each bottle is usually most conveniently done at the weir outfall.

It will be found convenient to write on each bottle the nature of the liquid, the date and the hour of drawing; this can be done with grease chalks upon the glass direct, or adhesive labels can be used.

As each hourly bottle is filled the stopper should be allowed to sink down gently into place in the bottle neck; if this is not carefully attended to there is considerable risk of casualties when an attempt is made forcibly to unstopper the bottle. After stoppering the bottles should be set in a row in the order of the times at which they were filled. It will be found, when the twenty-four bottles are ranged in a row, that a wonderfully good idea can be obtained visually of the variations in the character of the sewage thruout the twenty-four hours.

¶ THE STEPS IN THE PROCEDURE *are set out in detail that the results may be fully explained and comparable, conditions being fixed as closely as possible.*

A point now arises as to the inclusion of fragments of fæces in a sample. Altho they are usually omitted when taking chance samples direct with half-winchester bottles, this would appear to be a faulty method of sampling in certain cases, especially where the crude sewage subsequently undergoes treatment in septic tanks. If they are included they will need to be broken up in the hourly sample bottles before the proportionate amounts are drawn off.

After the last of the twenty-four hour samples has been taken, and the recorder pen has reached the 9 a. m. ordinate on the chart, the chart can be removed and replaced by a fresh one, and the hourly rates of flow worked out and entered up on the finished chart. The date, rainfall (if any) and other notes of interest should be recorded, such as times of weakest and times of strongest sewage, flushes of trade wastes, etc. For working out the hourly flows on recorder charts I use a special slide rule, which has the advantage of shortening the labor considerably. In the case of a recorder provided with a cam, the discharge can, of course, be taken direct from the chart, but with a recorder that only registers the height, height diagrams have to be translated into discharge diagrams.

The next step is to take from each bottle, commencing with the 9:30 sample, an amount proportionate to the rate of flow for each hour, and to transfer it to the large mixing bottle. Assuming the flow for the first three hours to have been severally 5,000, 6,500 and 8,500 gallons per

hour, then if 50 c.c., 65 c.c. and 85 c.c. are taken from the first, second and third bottles respectively, these amounts will be proportionate to the rates of flow for those hours, and the same procedure must be followed with the twenty-one remaining hourly samples.

The measurement of the liquid from the hourly sample bottle is best effected by means of a tall glass cylinder graduated in cubic centimeters. Before the sample bottle is unstoppered it should be turned over once or twice to mix the contents and any large solids should, if present, be broken up with a glass rod. In many cases the hourly amounts to be taken from each bottle can be obtained by knocking off two or more figures from the right of the hourly rates of flow, and if the figures thus obtained are inconvenient, the whole of these can be either divided or multiplied by a common factor. Care should be taken that the aggregate of the figures adopted is sufficient to yield enough liquid for the final sample; and it is better, if this can be done, to take sufficient liquid to fill two half-winchesters in case of breakage of one of them.

The working out of the chart and the sub-sampling, together with the entering up in the proper hour-spaces of the chart of the times of strongest and weakest sewage, presence of trade wastes, etc., take some considerable time; and while this record is in progress the reserve bottles previously mentioned will be needed to take the first few hours of the second set of samples.

¶ THE METHOD *of obtaining an average sample of the twenty-four hours flow of sewage must be followed closely.*

When the proportionate contents of the twenty-fourth hourly sample bottle have been transferred to the mixing bottle, the whole of the contents of this large mixing bottle should be gently agitated while the half-winchester bottle or bottles are being filled from it, in order to keep the suspended solids evenly distributed thruout the liquid. After the half-winchesters are thus filled, the hourly sample bottles can be emptied, washed out with clean water and set to drain. In cold weather, half-winchesters, or winchesters, filled with sewage, tank liquor or effluent, should be filled brimful, and the stoppers gently worked in, and tied down with a piece of calico or string; in hot weather, and also in keen frosty weather, a small air space may be left at the top of the bottle in the case of sewages or tank liquors. The samples should be dispatched to the laboratory carefully packed in wicker cases or hampers, nothing being better than old crumpled newspaper for packing the bottles in. It is often useful to have a special sample of the weakest early morning sewage, taken in a half-winchester, to be examined for nitrates. These, if present, indicate the presence of subsoil water in the sewage.

It may be noted that in the case of very small sewage works, where an automatic height recorder cannot be obtained, depths over the weir can be taken with a thin steel rule, one edge of which is ground thin. Depths should be taken sufficiently far from the weir sill to avoid curvature, and it will be found that if the rule is rubbed lightly against a block of wet clay and allowed to dry before each reading, the exact depth can easily be seen at a glance. The gaging of sewage flows in this way is very tedious, since readings should be taken every ten minutes, or at even shorter intervals, should the flow of sewage fluctuate much, as will almost certainly be the case with a small sewage works. At least three observers are needed for the twenty-four hours for taking sill depths and drawing samples.

¶ AN ALTERNATIVE METHOD *of obtaining an average of samples instead of an average sample is described.*

There is another method of taking average samples, in which samples are taken at regular intervals thruout the twenty-four hours, each of these samples being analyzed separately; a "weighted sewage" can be obtained by multiplying each separate analysis by the rate of flow at the time the sample was taken, the results are then added up and divided by the total flow.

Some years ago the writer, having occasion to take a large number of average samples, designed an instrument for taking samples directly proportionate to the rate of flow in one operation. Briefly described, the instrument consisted of a paraboloid copper tube or container, about 12 inches long, ranging from 5/8 inch at the bottom to about 2¼ inches at the top, the several diameters being calculated from the gaging formula. This tube was attached to a sliding metal stem working up and down in sockets screwed on to a rod provided with a thin sole plate, upon which the tube rested when the sample was taken. When in use the tube was raised clear of the sewage tank liquor or effluent, and the sole plate placed on the measuring stud, which was about 1/8 inch —*i. e.*, the thickness of the sole plate— below the level of the weir sill. The tube was then dropped thru the liquid on to

the sole plate, and the intercepted liquid poured off direct into the mixing bottle; a thin rubber pad lying in a recess in the foot or sole plate prevented any escape of liquid, while a strong clip at the head of the instrument kept the container tube well home against the rubber. In this way, at each sampling, a portion of liquid was withdrawn proportionate to the flow of liquid; in other words, proportionate to the height of the liquid flowing over the sill. Like most automatic contrivances, however, while possessing many marked advantages with certain liquids, containing suspended matter of moderate size, it had also several drawbacks, and the longer and more tedious method already detailed is to be preferred in most cases.

There are home-made automatic samplers to be seen in use at several sewage works, most of them actuated by a small water-wheel driven by a flow of sewage, tank liquor or effluent.

Municipal Swimming Pools

The city of Denver, Colo., has paid much attention to swimming pools and several of its parks are provided with them. The pool in Sloan and Cooper Lakes park is shown in part in the accompanying photograph.

Cooper Lake represents the city's most recent effort to develop a swimming pool. It is especially interesting because it shows the gradual process by which a natural body of water is changed into an attractive bathing beach. First a life guard was secured; then the old tent which had served as a bath house at Washington Park was taken down from the attic of the work house and removed to Cooper's Lake to serve once more. Next a boat was borrowed. Thus, with life-guard, boat and tent, "the old swimming hole" at Cooper's Lake has come under the supervision of the city and all who will are invited to come out and have a swim. Still there are weeds and mud, but what does a boy care for these?

If the numbers that come steadily increase, as doubtless they will, the city will from time to time make such improvements as seem desirable and in this manner Cooper Lake, the most typical swimming hole in Denver, will be changed into a well equipped bathing beach.

Sewage Disposal in Montana

From a paper by A. L. Jaqueth, of Kalispell, Mont., and the discussion of it, the following is taken regarding practice and results in that state:

The septic tank is an elongated tank or basin, thru which the sewage is allowed to flow at a very slow rate of speed, the effluent water passing over a weir and then thru the flush tank and intermittent filter beds.

While the sewage is slowly passing thru the tank, the heavier particles of organic or mineral matters sink to the bottom. The former is immediately attacked by the anaerobic bacteria, which rapidly multiply to countless millions,

SWIMMING IN COOPER LAKE *a preliminary stage to the park swimming pool which follows when the demand becomes too great for the few facilities offered in this suburban park.*

and quickly break up the organic matter into its gaseous and mineral constituents, the latter sinking to the bottom of the tank, the former rising to the surface and passing off into the atmosphere. In this manner the sewage is prepared for the filter beds.

Sewage disposal plants having sand filters should remove 85 to 98 per cent. of the organic matter from the sewage, and 98 to 98.8 per cent. of the bacteria.

A sewage treating plant with septic tank and sand filters, installed by Mr. Jaqueth, worked as follows After having been installed for five months, and after the first few weeks of installation, the effluent was perfectly clear and without odor, and no deposits have been formed in the many water holes along the outlet.

Immediately below the disposal plant, below the old sewer outlet in this small water course, before the plant was built, the sewage had been retained in the creek until a regular settling basin had been formed, which on warm days was very offensive, a constant ebullition being present. The appearance of the creek for about a mile below the outlet was that of a black, bubbling mass, which, if stirred with a stick, would give off a stench such that it was impossible to remain near. One of the farmers living about one-fourth of a mile from the sewer outlet sued the city for damages for maintaining a nuisance, and collected $2,500. Several others had informed the city that unless the nuisance was abated they would commence similar suits against the city.

Since the plant has been in operation, all nuisance has disappeared, and the water in the creek is now clear and fresh. The hole just below the plant, which was formerly a nuisance and a menace to health, is now perfectly clear, without any odor whatever. This disposal plant cost approximately $3,000 and is used by a town of approximately 1,200 people.

The tank is about 7 feet deep and 7 feet by 20 feet square. After six months use there was about 3 feet of sludge in the bottom. They drew it off on to a sludge bed, about 90 per cent. of it being water. After the sludge had dried you could take it up in your hand and breik it up, and it was almost like a powder, a black powder. The tank treated about 100,000 to 120,000 gallons of sewage a day.

Butte never needs to have any purification as long as the state authorities allow the city to use Silver Bow Creek. There are no people or communities on the stream below Butte that use the water, and, in fact, the water is already polluted before it reaches the city from the mills and concentrating plants.

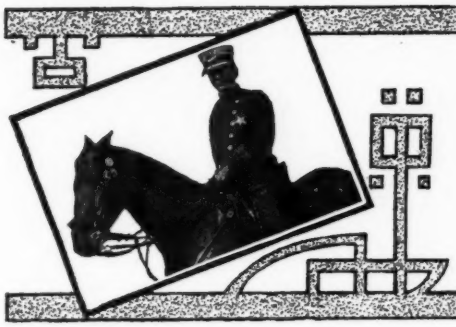
Bozeman as the result of what experiments will be carried on under the direction of the college and board of health and the city will choose some sort of disposal plant and make a bond issue to take care of it.

There has never been any discussion by the citizens of Great Falls on the subject of sewage disposal. It is approximately 2,000 miles before the water is again used as a domestic water supply. The constant unsatisfactory condition of Milk River is sufficient in itself to make the water supply of the Missouri River unsatisfactory unless the water is purified by some of the mechanical means at present in vogue. Above the Milk River there is only one town that would ever need river water, Fort Benton. At the present time they are supplied from a well system, and have received such concessions in the matter of power that they cannot save anything by going to the river. The one other community that is in any wise influenced is an adjacent community on the other side of the river, and steps are being taken at the present time to include that platted ground within the corporation limits of the city of Great Falls. When that is done its water supply can be connected with Great Falls and make it unnecessary for them to use the river water. In the early spring there has been a great amount of typhoid fever, but after the installation of a hypo-chlorite treating plant at their pumping station this epidemic immediately abated, and at the present time there are practically none of the typhoid cases left on that side of the river. Aside from this, the condition of the river below Great Falls is very satisfactory to facilitate self-purification. Behind the dams is sedimentation, where organic matter will be settled out and settle the sludge in the bottom of the river; passing the dam it passes over cataracts, dams and riffles to be thoroly aerated.

The State Board of Health has some control over sewage and water purification, as well as plans for sewerage and water supply, and has issued instructions for preparing plans for submission to the board. The board has some power which it can use in forcing sewage purification, in addition to its power to approve or disapprove of the plans presented by a municipality.

Portland Cement for Argentina

Consul General R. M. Bartleman, of Buenos Aires, Argentina, has forwarded to the Bureau of Foreign and Domestic Commerce a copy of conditions for supplying portland cement destined for public works in that country. He has also sent a translation of the principal portions of the document, which may be obtained by interested persons.



LEGAL DECISIONS

Electric Company Cannot Refuse Service

The Appellate Division, by overruling unanimously an order of the Public Service Commission, First District, New York, has made an important decision concerning the obligations of lighting and power selling corporations to the public. C. Perceval, a provision merchant, made application on July 13 last year to the New York Edison Company for a supply of electric current for lighting, power and storage and refrigerating purposes. When the standard forms of contract were sent to him, he struck out the clause forbidding the use of other electric service without the previous written consent of the New York Edison Company, on the ground that he had already contracted for electric current from 7 a. m. to 5:30 p. m. from the Wing Building, next door, which had a private generating plant.

Then the New York Edison Company refused to supply current for only certain hours during the day, and, says the Appellate Division, placed "itself squarely upon the position that it was under no obligation to furnish electric current to any one unless that person agreed to take from the company all the current which he required." Mr. Perceval applied to the Public Service Commission, but it gave a decision in favor of the corporation, and it was from its ruling that the appeal to the Appellate Division was taken.

This court now decides that, in consideration of the privileged position of the New York Edison Company, not the least of which is the right to use the public streets and highways for carrying its conduits, it is bound to serve impartially every member of the community who demands its services. It may, the court acknowledges, establish reasonable regulations which the consumer must observe, but the requirement that a consumer must take all of his electricity from one company or receive none "is not in any proper sense a regulation respecting the use of the service, but it a purely arbitrary attempt on the part of the company to insure to itself a monopoly of furnishing electrical current."

If that were permissible, the court points out, the company could also refuse to furnish current to a consumer who was manufacturing for himself part of the current he needed, and this had already been severely condemned upon grounds of public policy. Moreover, if the company had established the fact that the hours during which the supply of current was asked of it were those in which the greatest demands were made upon its services, this condition could have been met by making a special rate for the service.

So the case was sent back to the Public Service Commission to make such orders as might be proper.

Massachusetts City Cannot Reduce Gas Rates Below Cost

The application by the Municipal Light Board of the town of Wakefield, asking that the Massachusetts Board of Gas and Electric Light Commissioners consent to the establishment of certain prices for gas, alleged to be less than cost, has been refused.

The town owns both a gas and an electric plant which it has operated since 1894. The prices which the Municipal Light Board and Manager proposed to establish were $1.40 gross a thousand cubic feet for gas, with a discount of 20 cents for prompt payment, or $1.20 net. The present prices are $1.50 per 1,000 cubic feet, with a discount of 20 cents for prompt payment for 100 to 19,900 cubic feet, 30 cents for 20,000 to 29,900 cubic feet, 40 cents for 30,000 to 39,900 cubic feet, and 50 cents for over 40,000 cubic feet a month.

With respect to the price of gas, the board, from its examination since the hearing, is convinced that the operating expenses alone of the gas business exceed $1 a thousand cubic feet of gas sold. During the fiscal year ending June 30, 1913, they amounted to nearly $1.12; for the calendar year 1913, by reason of larger sales and a somewhat better disposition of

residuals, this operating cost was reduced to $1.05. For the past two and a half years it has averaged $1.08. In addition to the operating costs, the statute requires the price to include interest on the investment, the maturing debt requirements and the depreciation reckoned at 5 per cent. on the cost of the plant. There is a fair chance for some difference of opinion as to the amount of the investment, but upon the basis most favorable to the petition of the management, these fixed costs have exceeded 40 cents. Even if depreciation be reckoned at 3 per cent., as is permitted for a different purpose by chapter 411 of the Acts of 1906, and if the maturing debt requirements are omitted, these fixed charges have exceeded 30 cents. The average net operating expenses for the past two and a half years have been $32,700, and the average annual sales, 30,129,375 cubic feet. It thus appears that if all this gas had been sold at $1.20, the resulting revenue would not have been sufficient to pay 4 per cent. on the gas investment and make any provision for depreciation.

In view of these facts it is reasonable to expect that, if the board's consent is given to the establishment of the proposed maximum net price, all of the gas supplied by the plant to its consumers will be sold at a substantial loss. A reduction in price often stimulates a demand which results in an increased output without a corresponding increase in cost, and the business problem which this fact suggests is always to be considered. But in this case there is no sufficient reason to believe that a loss so substantial is likely to be absorbed by the increase in output to come from the lower price. The last annual statement of the financial condition of the business indicates losses which have not yet been recovered. Without an extensive and thoro investigation it is impossible to determine when or how this loss occurred, and for the decision of the present case this seems to be unnecessary. Some portions of former losses have been recently regained, particularly in the last three years. Until these can be further reduced, however, it would seem to be the part of ordinary business prudence for the town to require consumers of gas to pay all the operating expenses and fixed charges.

In view of the foregoing consideration, the board has voted to refuse consent to the net price of $1.20 for gas to be sold and delivered by the town of Wakefield.

Decisions of the Higher Courts of Interest to Municipalities

Right to Percolating Water Under Property not Acquired with Property.—A town, which pursuant to St. 1908, c. 404, acquires land bounded by a stream for a water supply, does not acquire the rights of an owner of percolating waters under the land; and where it drills wells, and thereby intercepts water which would otherwise flow into the stream and a millpond, it is liable for the taking of property of the owner of the pond. The same statute makes the town liable for compensation to persons damaged in acquiring its water supply.

Acceptance and Substantial Performance of Contract.—Where the board of public works of a city refused to approve a street improvement work, because not in compliance with the contract, and then directed the city engineer to determine what deductions from the contract price should be made for noncompliance, and the city engineer reported that a deduction of a specified sum would cover the difference between the improvement as constructed and its value if in strict compliance with the contract, and thereafter the board accepted the improvement on the contractor's filing an acceptance of a settlement calling for a reduction of the specified amount from the contract price, and certificates were subsequently issued by the board, the board accepted and approved the work and adjusted the claim of the contractor. Substantial performance of a street improvement contract is performance, provided no damage is suffered by the contractor's failure to literally perform. Transfer Realty Co. v. City of Superior (Wis.:), 147 N. W., 1051.

Remission of City Taxes Valid Return for Water.—In 1879 the city of Millville agreed with the Millville Water Company that, if the company would erect a plant and do all things necessary to supply the city with water, the city would take such supply, and would annually, in compensation therefor exempt the water company "from the payment of all taxes except those levied for state and county purposes." In 1912, in violation of this agreement, the city having received its water supply, compelled the water company to pay the tax due to the city for that year. Thereupon the water company sued the city for the price of the water so furnished, fixing in its complaint such price as the amount of the tax so paid. On a motion to strike out this complaint on the ground that the agreement to exempt from payment of taxes was void as against public policy, *held*, that, as between these contracting parties, the true construction of the agreement was that the city would pay for the annual supply of water furnished to it by the water company a sum equal to the amount of the tax payable for that year by the water company to the city. Millville Water Co. v. City of Millville (N. J.), 90 Atl. 1907.

Municipal Notes

A Brick Road As A Monument

Near Pana, Ill., John W. Kitchell, is laying a brick pavement in honor of his father-in-law, a pioneer in Christian county, which will be known by his name as the Robert Little road.

This is the first brick highway to be laid on the country roads of central Illinois. It will be 3¼ miles long and will extend from the village of Rosemond to the Rosemond Grove Cemetery, a country burying ground five miles west of Pana.

The width of the brick portion is 16 feet from curb to curb. On one side will be a dirt road 10 feet in width and on the other side a dirt berm of 4 feet. Beyond these dirt strips will be side ditches to carry off the water.

Captain Kitchell has two other reasons for building it:

To give the people of the village of Rosemond a pleasant drive for their funerals when bad weather makes the dirt roads impassable.

To encourage the building of good country roads, not alone in his own community, but thruout the state.

It will be the only public highway in Illinois not paid for by the sale of bonds. The $55,620 to pay for its construction is waiting till the contractor finishes his work.

Bond-Terms for Constructing Public Works

The following resolutions presented to the Convention of the American Society of Engineers, Architects and Constructors, by Col. J. W. Howard, of New York, Consulting Engineer on City Planning and Pavements, were unanimously adopted:

"Whereas, One of the important elements of good government and its continuance in the cities, counties and states of our Nation, consists in sound, honest financing of public works; and,

Whereas, A pernicious practice has appeared in many places, of issuing public bonds for terms longer than the life of the pavements, roads, sewers, waterworks, bridges, some public buildings, etc., for which such bonds have been sold; and,

Whereas, Such a practice places unjust tax burdens upon us later in life, and puts our children in debt, some before they are born; and for things which they will have never used nor seen.

Wherefore, Be it Resolved, That the Society of Engineers, Architects and Constructors, protest against bonds for public improvements and works, being issued for periods of time longer than the reasonable life or durability of the several kinds of construction, for the payments of which said bonds are issued by cities, counties, states or the U. S. Government; also that it is certain that more continuous employment of capital, engineers, architects, constructors, artisans, mechanics and laborers; also greater and steady prosperity, will hereby be assured."

San Francisco's Municipal Band

San Francisco's Municipal Band is over two years old, having celebrated its second birthday on July 1. During the two years it has given one hundred and twelve entertainments, to the delight of many thousands of people.

It has been the aim to give every section of the city an opportunity to enjoy the high-class music produced by the band, and over forty districts have been visited.

Nearly all of the smaller parks have been provided with music on at least one occasion and also all of the playgrounds. In sections not favored with these public spaces, school house grounds have been utilized, to the advantage of the people of the neighborhood.

It is a significant testimonial to the salubrity of San Francisco's climate to state that during the past two years only three concerts had to be postponed on account of the inclemency of the weather. Winter and summer, the concerts are held in the open air.

The local improvement clubs have co-operated to make the gatherings a success and have frequently added other attractions to that provided by the band.

So popular has become the Municipal Band that a demand is being created for its services at evening street dances, and if ways and means can be found, an attempt will be made to meet this demand.

The Supervisors appropriated $10,000 a year to support the band. The Publicity Committee of the Board arranges for the concerts, except that the musical program is prepared by John A. Keogh, the director.

Regulation of Automobile Traffic

The police department of Joliet, Ill., has issued the following order:

All automobilists in Joliet who stop on either side of the street on Chicago street between Jefferson and Webster streets, and on Clinton street, between Chicago and Scott streets, shall park their cars with the nose into the curb, at an angle of not less than 45 degrees and with the inside rear wheel not more than 5 feet from the curb. Cars shall be parked not less than 10 feet from any hydrant.

Congestion of traffic is the cause of this order. With the machines parked in this manner on Chicago street, any vehicle can pass between the rear of the machine and the street car tracks with ease. On all other "loop" streets the old system of parking cars will be used, on account of the narrowness of the streets.

Signs, to be erected at certain distances on all sides of Joliet schools, warning the approaching automobilists of danger, are being placed, fifty-five signs having already been erected.

Good Roads Movement in Northern Illinois

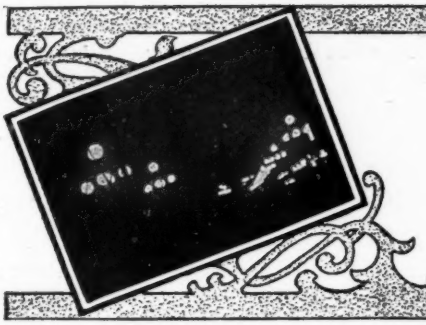
A committee from the Will County (Illinois) Automobile and Good Roads Association will appear before the county board in December and ask that a $500,000 bond issue be submitted to the vote of the people.

Amendment of the Tice good roads bill, passed at the last session of the legislature, so as to include macadam roads in the list of state aid roads, will also be urged by the club.

Efforts of the club will be directed next spring to the completion of the Chicago-Joliet automobile highway, and energies to have the next state aid money expended on this twenty-nine-mile stretch will be used.

Public Comfort Station in New York

The photograph shows one of the types of public comfort station in use in New York, which now has many of these conveniences in use. The stairway to the left is for men and that to the right for women, running in opposite directions but without a man-high screen between them above the sidewalk level.



Lighting

Ornamental Lighting by Assessment

The city of Spokane, Wash., establishes ornamental lighting districts and provides for the assessment of the cost on the property benefited. Thus the First avenue system is extended under a resolution reading as follows:

Notice to Property Owners of Hearing on Resolution for First Avenue Ornamental Street Lighting System, Bernard Street to Cedar Street.

Be it resolved, by the city council of the city of Spokane:

That it is the intention of said council, and such intention is hereby declared, to order the improvement of First avenue, in the city of Spokane, from Bernard street to Cedar street, by the installation and maintenance of an ornamental street lighting system thereon.

The nature and territorial extent of such proposed improvement are as stated above.

The cost and expense thereof is to be borne in whole or in part by the property specially benefited thereby, and the boundaries of the proposed assessment district are particularly described as follows, to-wit:

Beginning at a point on the west line of Bernard street 90 feet north from the north line of First avenue; thence west along a line parallel to and 90 feet north from the north line of First avenue to the east line of Cedar street; thence south along the east line of Cedar street to a point 90 feet south from the south line of First avenue; thence east along a line parellel to and 90 feet south from the south line of First avenue to the extended west line of Bernard street; thence north along the extended west line and the west line of Bernard street to the point of beginning.

That a hearing on said matter will be held before said council in the council chamber on the 3rd day of August, 1914, at 2 o'clock p. m., at which time and place all persons who may desire to object thereto may appear and present such objections, if any they have.

The commissioner of public utilities is hereby directed to submit to the city council at or prior to the time fixed for said hearing the estimated cost and expense of said improvement and a statement of the proportionate amount thereof which should be borne by the property within the proposed assessment district, and a statement of the aggregate assessed valuation of the real estate exclusive of improvements within said district, according to the valuation last placed upon it for the purposes of general taxation, together with a diagram or print showing thereon the lots, tracts and parcels of land and other property which will be specially benefited thereby, and the estimated amount of the cost and expense of such improvement to be borne by each lot, tract or parcel of land or other property.

Rules of New Hampshire Public Service Commission Respecting Gas Supply.

The Public Service Commission of New Hampshire has issued (effective February 1st) rules prescribing standards for purity, pressure and heating value of gas, and otherwise regulating the service of gas utilities, from which the following extracts are taken. It is worthy of note that nothing is said as to candle power or photometric tests, the thermal value being accepted as the determining factor.

A cubic foot of gas shall be taken as the quantity in a volume of 1 cubic foot when saturated with water at 60 degrees F., and under a pressure of 30 inches of mercury.

No utility shall supply gas having a monthly average total heating value of less than 600 B.t.u. per cubic foot, tested anywhere within one mile of the manufacturing plant; and at no time shall the heating value be less than 550 B.t.u.

Each utility which in any year shall

have sold more than 20,000,000 cubic feet shall equip itself with a calorimeter and shall determine the heating value of its gas on at least three days in the week. A record of each such test shall be made and be open to the public.

No gas shall contain more than 30 grains of total sulphur, or 10 grains of ammonia, per 100 cubic feet, or more than a trace of hydrogen sulphide. Gas shall be deemed to contain more than a trace of hydrogen sulphide if a strip of white filter paper, moistened with a solution 6½ per cent. by weight of lead acetate, after being exposed for 1 minute to a stream of the gas flowing at the rate of approximately 5 cubic feet per hour, the gas not impinging directly from the jet upon the paper, appears perceptibly darker than a second paper freshly moistened with the same solution.

Each utility shall daily test the gas leaving its holders for the presence of hydrogen sulphide in the manner specified, and shall keep a record of such tests.

The commission will, from time to time, inspect the methods of manufacture, and test the quality of gas supplied. A fee of $15 will be collected from the utility for each such inspection.

Gas pressure, as measured at the outlet of the service to any consumer, shall never be less than 2 inches nor more than 8 inches water column. The maximum daily pressure variation shall not exceed 3 inches water column.

Each utility shall provide itself with one or more portable recording pressure gages, and shall regularly, and not less frequently than the commission may direct, make measurements of the gas pressure, and pressure variation thruout the system. Records of these measurements shall be kept open to public inspection.

No gas meter shall be placed in service which has an error in measurement in excess of 2 per cent. when passing gas at the rate of 6 cubic feet per hour per rated light capacity of such meter.

All new meters purchased, and all old meters which have been repaired, adjusted or removed from service, shall be tested and marked with the date of test before being placed in service; and all meters shall be removed and tested at least once every 5 years. During each period of 12 months, until all such meters have been tested, each utility shall remove for test not less than 20 per cent. of the meters now in service, those longest in service being removed first.

Each utility shall, without charge, make a test of the accuracy of any gas service meter upon request of the consumer, provided the consumer does not make such request more frequently than once in 12 months. A report giving the results of each request test shall be made to the consumer.

Any gas meter may be tested by an inspector employed by the commission, upon written application of the consumer, and deposit of the fee fixed for inspection. If the meter is found to be more than 2 per cent. fast the fee paid by the consumer will be returned to him, and shall then be paid by the utility. Each application to the commission for test of a meter shall be accompanied by a fee of $1, the fee for testing any meter having a rated capacity not greater than 10 lights. For meters of greater capacity a deposit equal to the estimated cost to the commission will be required.

The commission will, from time to time, test such meters of each utility as it shall judge expedient. A fee of 50 cents will be collected from the utility for each meter so tested which is of not greater than 10 lights rated capacity, and for each meter of greater capacity a fee equal to the cost to the commission of testing the same.

Whenever a meter is tested under this rule and found more than 3 per cent. fast, the company shall return to the consumer that percentage of the amount of the bills for the previous 6 months, or for the time the meter was in service, not exceeding 6 months; provided, however, that the commission in any case may relieve the utility from this requirement to such extent as the facts may appear justly to require. Whenever a meter so tested is found to be more than 3 per cent. slow, the utility may make application to the commission for authority to render a bill to the consumer for gas supplied during the preceding 6 months, not covered by bills previously rendered; but such application should be made only in cases of substantial importance, and should be accompanied by a statement showing the utility not to be in fault for allowing the incorrect meter to be in service.

Whenever a gas meter is tested the original test record shall be kept, indicating the information necessary for identifying the meter, the reason for making the test, the reading of the meter before being removed, and the result of the test. This record must be sufficiently complete to permit the convenient checking of the methods employed and the calculations. Records shall also be kept, numerically arranged, indicating approximately when each meter was purchased, its size, its identification, its various places of installation, with dates of installation and removal, and the dates and general results of all tests.

Each utility shall maintain a suitable meter prover so located as to be shielded from excessive temperature disturbances and equipped with thermometers and oth-

er necessary accessories, and approved and sealed by the commission.

Bills rendered periodically for metered gas shall designate the reading of the meter at the beginning and end of the interval and the dates of the readings.

Each utility shall keep a record of all complaints made in regard to service, which shall include the name and address of the complainant, the date and nature of the complaint, and the disposition of the same.

Each utility shall provide, equip and maintain a station for the testing of gas and gas meters, and such equipment therefor as may be necessary for the testing required by any rules of this commission, and shall provide such facilities for the use of the commission's inspector as the commission may prescribe, to be arranged in a location and according to plans approved by the commission.

Each utility, at such times and in such form as the commission shall prescribe, shall report to the commission the result of all tests made of heating value, purity and pressure of the gas supplied by it, and the number of meters purchased, installed, removed from service, tested, adjusted and repaired.

Los Angeles Opposes Refunding of Electric Railway Bonds at Higher Interest Rate

City Attorney Albert Lee Stephens, of Los Angeles, gave a brief statement of the grounds of the city's intervention in the application of the Los Angeles Railway to the State Railway Commission for permission to consolidate certain subsidiary companies, and carry thru a comprehensive plan of financing, at a hearing a few days ago. The company seeks approval of a plan whereby it may pay as much as 6 per cent. interest on bonds, and may refund underlying 5 per cent. bonds of companies that will be absorbed in the consolidation with 6 per cent. bonds.

The financially strong position of the company is not contested by the city, nor the propriety of issuing bonds to finance extensions which are much needed. The city does not wish to place any obstacles in the way of the company's development. It feels, however, a duty in view of the possibility that municipal ownership of the utility may be desired at some future date, of asking that if it can possibly be avoided, outstanding 5 per cent. bonds shall not be refunded at 6 per cent., which will mean the addition of $230,000 annual charges.

The city also feels the commission's decision should so run that when substantial issues of securities are to be made in the future, they shall issue only upon specific permission of the commission after due proceedings in each particular case, and that rate of interest shall be determined for each issue, on the theory that altho 6 per cent. may be necessary to secure the money this year, easier financial conditions may obtain in the future, so that future bonds would command a market at a fair price altho bearing less than 6 per cent. interest.

By taking this position, the city seeks to give due prominence to the factors that would reduce interest charges upon the city treasury, in the event of the city's taking over the electric railway system, and assuming the annual charges involved in bond interest.

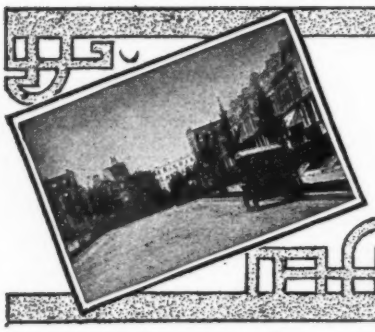
Commissioner Edgerton, commenting informally on the matter at the hearing, suggested that there is at least a sentimental element of advantage in an underlying bond, and that holders of the underlying 5 per cents might not be willing to relinquish them for a general mortgage bond, unless there was some cash inducement, an dthat "if a reasonable amount is paid to get rid of the underlying securities, it is a burden that the public may very well pay for the advantage of obtaining the extensions. The question of what is a reasonable amount is a subject for consideration."

Lighting the Lincoln Highway

Aurora, Rockford, Joliet and other Illinois cities are placing lights along the route of the Lincoln highway within the city limits, the automobile clubs usually supplying either the lights or the special globes, which are square, with red, white and blue bands, and the letter L in the middle.

Gas-Lighting Tests at Montevideo

A test is now being made of lighting the port of Montevideo with high-pressure incandescent gas lamps. A trial installation of four Keith lamps, each of 3,000 candlepower, has been put up by the Montevideo Gas Co. These lamps, which are hung on iron columns some 20 feet high and placed along the asphalt way leading to Mole A, have two mantles each and are lighted by gas at a pressure of 2,030 to 2,540 millimeters of water. The mantles are inclosed in separate coverings of silica, which, besides having the advantage of being small, are not subject to damage or breakage, even if they become wet. The arrangement for giving the necessary pressure to the gas is simple. The gas is supplied from the street mains.



MISCELLANEOUS

Trade Sentiment in South America

Frank Lamkin, in a recent press letter says that he spent the past year traveling thru the leading countries of South America, in his capacity of export manager for ten American concerns. He finds that American manufacturers have the keenest possible interest in conditions prevailing in the southern continent. He says:

Only a man who has spent much time on the ground can appreciate the nature of the opportunities, or for that matter the silliness of many things written and said about selling conditions prevailing among our South American neighbors. What I write here is based on my own personal experience and observation. It is vital that Americans begin right in order to take the quickest and best advantage of the markets that are now laid open.

I have visited one of the largest buyers in South America, six times, on as many different trips thru Latin-America, and each time failed to get his order.

Last April I again called on this buyer, and to my surprise and delight, after a thirty-minutes' conversation, he asked my advice as to what would constitute a comprehensive stock of the merchandise I represented. My recommendations were accepted and an order given the following day.

After concluding the business, I asked him why he had decided on changing his policy toward American-made products.

"Well, I have got a premonition. It has been growing for a year, in fact, ever since your last call on me. I believe that eventually South America will get the bulk of its imports from the United States, and we are just about ready to make our change. I am credited with being a trifle more progressive than other dealers in this market, and this may account for my making a start earlier than the rest."

This incident fairly illustrates the situation thruout South America, and this apparent development of a sixth sense impressed the writer from the very first month of a year's trip just completed, that carried him thru all the principal Latin-American trade centers.

Sentiment toward the United States appeared changing, and while the efforts of the English and German business houses and newspapers have been actively directed to creating and maintaining a feeling of distrust toward American policies, products and business, the effort has not been entirely unfavorable to us. The manifestly fair attitude of our government toward Mexico, during the recent crisis, did much to assist the tide of sentiment favoring this country, and answered, effectively, many arguments advanced against us by the European representatives.

The trade visited was more inclined to consider the formation of business connections with American manufacturers and jobbers than on any of my previous trips. Native business men were disposed to place sample orders.

The Buffalo Brick Convention

The annual meeting of the National Paving Brick Manufacturers' Association in Buffalo on September 9 was followed in the evening of the same day by a conference with the sub-committee on standard brick pavement specifications of the American Society of Municipal Improvements and by two trips of inspection of brick street and road pavements in the vicinity of Buffalo on the two following days, on which the members of the association were accompanied by some two hundred of their invited guests. These guests were largely city, county and state engineers and members of their executive boards, with some representatives of the technical and trade press and of engineering schools.

The association has had a prosperous year, the brick manufacturers having had the greatest volume of business in their history. Its educational work and its work in promotion of the use of brick as paving material have maintained the high standing of the past, and there has been a material increase in membership, with no losses. The new members admitted at the convention are the Brick and Stone Co. of Waynesburg, Pa., Paul Beer. Des

Moines, Ia.; Carlyle Paving Brick Co., Portsmouth, O., and Lincoln Paving Brick Co., Canton, O.

The president again made his recommendation of the employment of one or more association engineers to use in educational work among city officials and others. The secretary's report shows the varied activities of the association from preparation of specifications and inspection of the work done by them to the issue of a periodical entitled *Dependable Highways*, leaving no avenue of presentation of the advantages of brick paving untraveled.

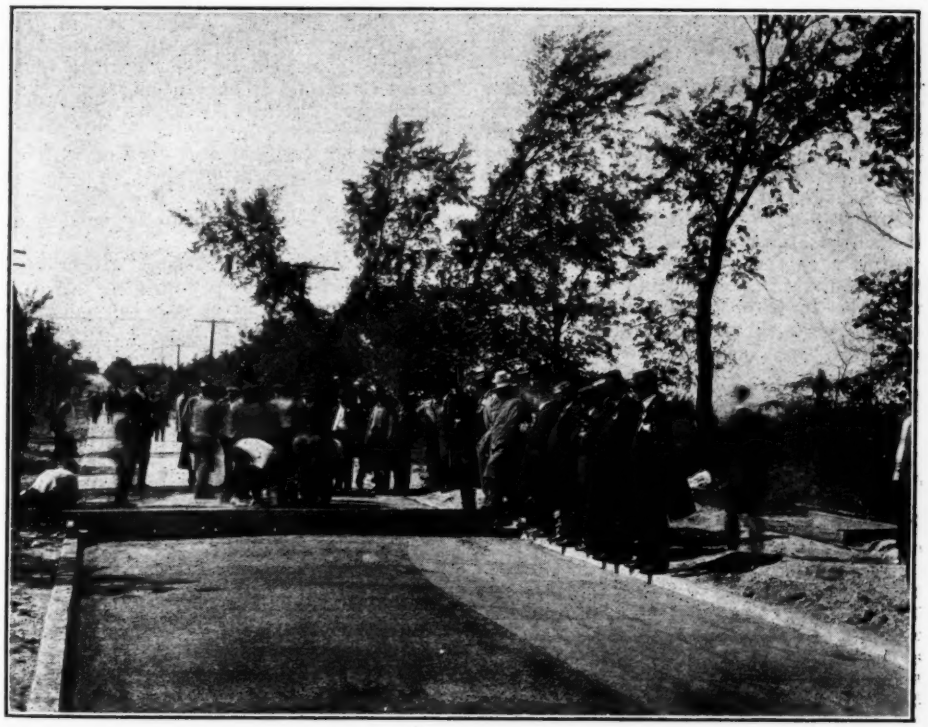
During the year the association has issued a new booklet of specifications with some modifications and improvements of former sets. This set of specifications was discussed with the members of the sub-committee of the A. S. M. I. who were present, E. H. Christ, chairman, Henry Maetzel, F. J. Cellarius and J. A. Vanderwater. It is probable that most of the changes discussed will be adopted by the committee and presented to the A. S. M. I. One important question which was thoroly discussed and upon which agreement was reached is factory mended, to be optional with the city, and not to prevent inspection on the street. Another question, on which agreement was not reached, was that of the method of selecting samples to subject to the abrasion test. This is a question on which the experts are not agreed and the conference referred it to them for answer after further experiment and discussion.

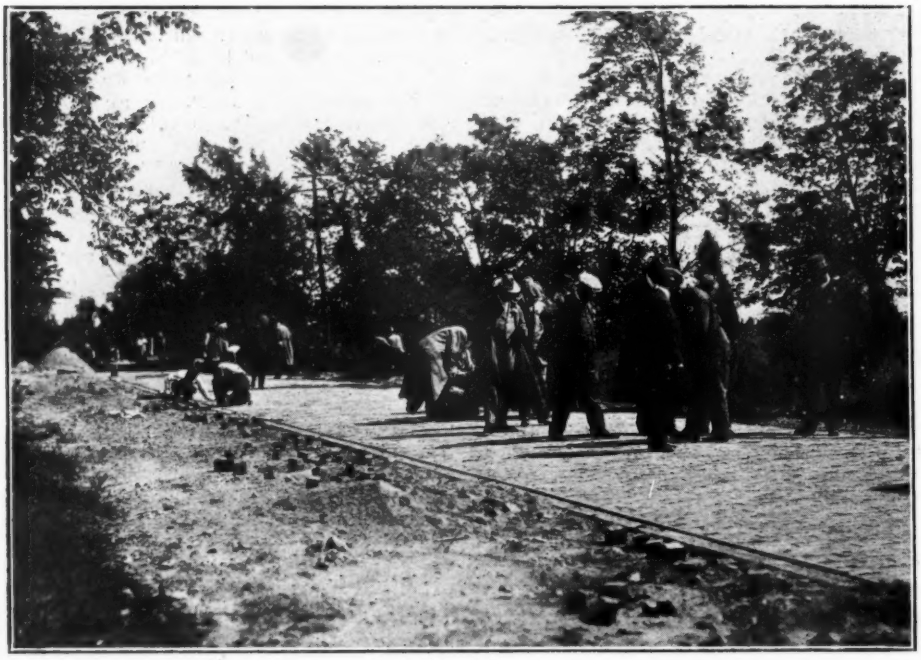
The banquet on Thursday night under the leadership of George C. Diehl, of Buffalo, was very enjoyable. The speeches included representatives of the state and county highway engineers and city engineers, the A. S. M. I., the engineering press and the technical schools.

The inspection trip on Thursday included highways in Erie county, most of them built by the State Highway Commission or under their supervision.

The oldest brick roads traveled over were about four years old and all were in excellent condition, the few defective areas being due to bad foundations, unauthorized use of culled brick, poor design and construction of transverse joints, the pavements having no transverse joints showing no such defects. Some crushing of filler and deterioration of joints was noted on curves, however, indicating that there should be some method of relieving the curves of the pressure from longitudinal expansion on the tan-

BRICK ROAD *under construction in Erie County, New York. Sand cushion prepared and men laying brick.*





CULLING BRICK *prior to rolling. Visitors inspecting the process and result. This is an important stage in the process of making a good street. Much depends on the judgment of the inspector.*

gents. The division engineer attributes 70 per cent. of the defects in brick pavements to poor foundations and 30 per cent. to poor grouting, those from other causes being too small in proportion to take account of.

The large amount of wire-cut-lug blocks in use was very noticeable, the excellent results with the early pavements, laid in 1910 with this form leading to their general use in later work. The work observed under construction was being laid with the wire-cut-lug blocks.

The two accompanying photographs show the preparation of the sand cushion and the inspection by the visitors of the brick laying and brick in place ready for rolling on the part of the Lake Shore drive under construction.

The guests of the association were hearty and profuse in their expressions of satisfaction with the results of the conferences and inspections and much excellent educational work was done along the lines upon which manufacturers' and engineers' organizations are working together in securing more uniform qualities of materials and better methods of construction.

American Road Builders' Convention

The program committee of the American Road Builders' Association reports that plans for the eleventh annual convention, to be held as the American Good Roads Congress, in the International Amphitheater, Chicago, December 14 to 18, are near completion.

Monday afternoon and evening will be devoted to registration and the sessions will begin on Tuesday. The sixth good roads show will be formally opened at 7:30 p. m. Monday.

In the forenoon of Tuesday will be held committee and other preliminary business meetings. At 2:30 p. m. the congress will be opened by President W. A. McLean and addresses of welcome by officials of Chicago and Illinois, and Illinois organizations interested in good roads.

The technical sessions will commence on Wednesday and will be held each morning and afternoon. On Wednesday evening, the association will hold its annual dinner.

Among the topics to be treated under the general classifications of organization, construction and maintenance are "Road and Pavement Dimensions—Widths, Depths and Crown;" "Road Foundations—Concrete, Telford, Gravel, etc.;" "Organization;" "Traffic—Present Tendencies, Probable Development and Regulation; "Machinery for Construction

and Maintenance;" "Brick Roads and streets;" "Surface of Floors for Bridges;" "Bituminous Construction and Mainteance — Recent Practice;" "Concrete Roads;" "Recent Practice in the Construction of Wood and Granite Block Pavements;" "Earth and Gravel Road Construction;" "Street Paving in Small Cities;" "Convict Labor in Road Construction," and "Dust Prevention and Street Cleaning."

On Thursday evening a popular session will be held with speakers of national prominence.

The exhibition feature promises to excel in extent and importance the exhibition of last year.

Exhibit of Street Cleaning, Refuse Collection and Refuse Disposal Appliances in New York

The Department of Street Cleaning of the City of New York proposes to hold an exhibition of street cleaning appliances during the week beginning November 23, 1914, at Recreation Pier, foot of 24th street and East River, Boro of Manhattan, New York City. The purpose of this exhibition is threefold. (1) To show the people of the City of New York the types of equipment now in service. (2) To give manufacturers of modern street cleaning apparatus an opportunity of exhibiting their various appliances, not only to the citizens of New York, but also to officials of surrounding communities who will be invited to attend. (3) To provide an opportunity for practical tests or demonstrations of street cleaning appliances under such conditions as will be acceptable to the city and manufacturers.

The street cleaning apparatus proposed for exhibition will cover all sorts of brooms, brushes, sweeping machines, flushing machines and other equipment or appliances used in cleaning streets and removing snow; garbage, ash and rubbish cans or receptables used by householders; carts, wagons, motor trucks or other vehicles used for collecting garbage, ashes, rubbish and street sweepings; conveyances for transporting refuse by water or by rail; methods used for the disposal of garbage, ashes, rubbish and street sweepings, including garbage reduction works, garbage crematories, incinerators, destructors, etc.

Minneapolis Discounts Its Bills

Upon receipt of any proper bill or invoice for goods, materials or merchandise purchased by the city (not including Library Board, Board of Education, Park Board and Board of Charities and Corrections) upon which a discount is allowed for prompt payment, the Purchasing Agent transmits the same to the head of the department for whose use the purchase was made, for approval and audit and prompt return. The Purchasing Agent adds his approval thereto and delivers invoice to City Comptroller for payment.

The Comptroller arranges with the City Treasurer for the immediate payment of the net amount of such bill, by Treasurer's check drawn on any bank in which city funds are deposited, which check, with the bill is delivered to the Comptroller who in turn delivers the check to the person entitled thereto. The Treasurer is reimbursed by a check warrant drawn upon the proper fund. A number of advance payments may be reimbursed by one check-warrant.

Failure or neglect on the part of heads of departments, whereby the city suffers the loss of a discount agreed upon for prompt payment, constitutes a misdemeanor, punishable as such upon correction.

The discount system was adopted and the first bill discounted on January 29, 1914. During the first three months 2,435 bills, subject to discount, were paid, amounting to $139,157.43, on which the discount was $2,199.58 or an average of 1.6 per cent. This is certainly worth saving when it is merely a matter of hastening the issue of the check by prompt passage of the bill thru the regular channels to payment.

Technical Associations

The Northwestern Road Congress will be held in Milwaukee, Oct. 28 to 31. More than thirty papers are on the program by state highway commissioners, U. S. road experts, governors and others. The States of Iowa and Wisconsin, and the city of Milwaukee will make exhibits, also Milwaukee county, showing its 100 miles of concrete roads, and the U. S. Office of Public Roads.

The Society for Electrical Development is sending out to manufacturers a letter on the South American market which should interest them and induce them to avail themselves of the aid which the society offers in the way of information, services in translation of circulars and catalogs for foreign distribution, and the like. J. M. Wakeman is general manager, 29 W. 39th St., New York.

The American Society of Municipal Improvements, meeting at Boston, Oct. 6-9, issued the best advance program offered for some years.

The Kansas League of Municipalities meets in Lawrence, Oct. 7-9.

The Minnesota League of Municipalities meets in Mankato, Oct. 21-22.

The California League of Municipalities will meet in Monterey, Oct. 12.

The American Highway Association holds its annual Road Congress in Atlanta, Ga., Nov. 9-14. Charles P. Light, business manager, Colorado Bldg., Washington, D. C.

The Conference of American Mayors for the Discussion of Utility Problems meets in Philadelphia, Nov. 12-14. Clyde L. King, acting director, 216 City Hall, Philadelphia, Pa.

The National Municipal League meets in Baltimore, Nov. 17-21. Clinton Rogers Woodruff, secretary, North American Bldg., Philadelphia, Pa.

The American Public Health Association meets in Jacksonville, Fla., Nov. 30-Dec. 5. S. M. Gunn, secretary, Mass. Inst. of Technology, Boston, Mass.

The Illuminating Engineering Society will meet in Cleveland, O., Sept. 21 to 25. A very interesting and instructive program has been prepared.

Technical Schools

Fred E. Ayer, dean of the college of engineering of the Municipal University of Akron, O., has prepared a report of an investigation of the pavements of Akron by the Municipal University, made in accordance with a resolution of the city council, which considers the conditions and difficulties and to some extent the result thereof. It also contains a report on the standard city form of contract and specifications, prepared by the New York Bureau of Municipal Research, with detailed criticisms of the same.

The announcements of the School of Commerce, Accounts and Finance for 1914-5, day and evening sessions, are contained in the New York University Bulletin of June 26, 1914.

Indiana University Extension Division has published a report of the conference on the question of the calling of a constitutional convention in Indiana, which was held at Bloomington, Ind., in June, 1914. It contains a valuable series of papers and discussions on constitutional questions and can be obtained from the University Bookstore for 25 cents.

Roger DeLand French, lecturer in municipal engineering at McGill University, Montreal, Que., wishes to receive catalogues and other literature from manufacturers of sewer pipe, steel sheet piling, castings, trenching machinery, etc., and all other apparatus and supplies used in sewer construction. These are for use in the course in municipal engineering at McGill University.

Civil Service Examinations

The U. S. Civil Service Commission will held examinations at the usual places as follows:

Oct. 7-8: Torpedo Engineer in Naval Torpedo Station, Newport, R. I., at $9.60 a day; 12 clerk-draftsmen in six surveyors-general offices in western states, at $1,200 a year.

Publications Received

The Exposition Fact Book of the San Francisco Exposition and a very handsomely illustrated booklet on "The Thirteenth Labor of Hercules," are issued and can be obtained by addressing the Panama-Pacific International Exposition Co., San Francisco. They are well worth the trouble of sending for them for beauty as well as information about the exposition and methods and cost of getting to it and seeing it.

The proceedings of the second annual meeting of the Montana Institute of Municipal Engineers contain several papers on municipal improvement. C. C. Widener, Bozeman, Mont., is secretary.

Proceedings of the ninth convention of the Nebraska Cement Users' Association, paper, 96 pp. Frank Whipperman, secretary, 28th Ave. and Sabler St., Omaha, Neb.

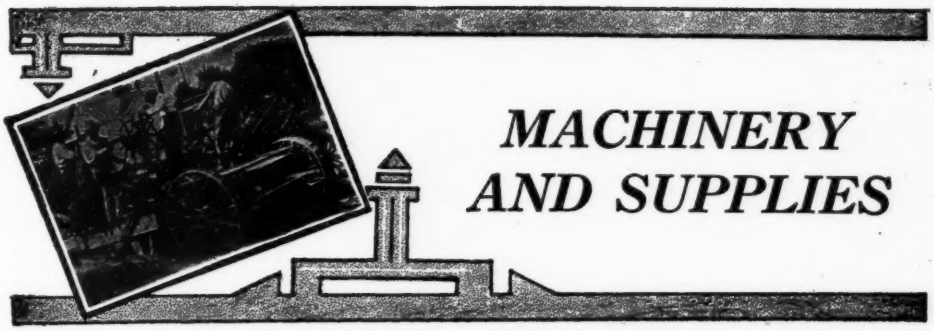
The official publication of the Illinois state highway department is called "Illinois Highways, was begun in April and is issued monthly by the department at Springfield.

The new catalog of the Rock Island Bridge and Iron Works, Rock Island, Ill., is largely devoted to steel towers and tanks but also shows their work in steel barges, structural and ornamental steel work, staircases, fire escapes, derricks, bridges, bins, etc.

Solvay Hydraulic Paint is the subject of a brief circular issued by the Semet-Solvay Company, New York and Chicago.

The August number of *Dependable Highways* is the first of the new publication to be distributed monthly by the National Paving Brick Manufacturers' Association to municipal officials, engineers, highway commissioners, contractors, manufacturers of brick and other clay products, clay working machinery and supplies, automobile clubs, civic and neighborhood clubs and the general public interested in better highway conditions. If not now on the list, ask for it from the secretary, Will P. Blair, B. L. E. Bldg., Cleveland, O.

The fall number of *The Koehring Mixer* is issued and contains information about the fall and winter exhibitions and a large picture of the mixer in use on Milwaukee county roads. It is issued by the Koehring Machine Co., Milwaukee, Wis.



MACHINERY AND SUPPLIES

Bermudez Road Asphalt

Five years of experience with Bermudez road asphalt in asphaltic macadam roads constructed by the penetration and mixing methods have demonstrated the durability of this material for this use, as it had already been demonstrated for use in asphalt pavements.

The purpose of asphalt in a road is to act as a cement to hold together the stone and other mineral aggregate. This makes it evident that the life of the road is dependent upon the continued cementing power of the asphalt. If it bleeds, cokes, volatilizes, loses its adhesive qualities and its ductility, the roadway will soon go to pieces.

Bermudez road asphalt is made of material of stable qualities from the famous Bermudez asphalt lake in Venezuela.

The conspicuous successes in road building that have been achieved by the use of Bermudez road asphalt in all sections of the United States and in Canada include roads constructed both by the mixing (asphaltic concrete) and penetration (asphaltic macadam) processes. In the former method the material is mixed hot with sand and stone, the mixture being then placed on a suitable foundation and rolled to absolute compaction.

Penetration roads are constructed by placing the stone on the roadbed in very much the same manner that is followed in the construction of an ordinary macadam road. Hot asphalt to the amount of about 1¾ gallons per square yard is then poured upon the stone, and after rolling a seal coat is applied, over which fine screenings are placed and the road again rolled.

No question whatever is raised as to the merits of the mixing method of construction, but doubt has been expressed in some quarters as to the desirability of penetration roads. This doubt is due to experience with penetration roads that were poorly constructed with poor materials. Penetration highways built in New York State and elsewhere in 1909-10 are in almost perfect condition today, in spite of the fact that they have received practically no maintenance whatever.

There are more than 12,000,000 square yards of Bermudez asphalt highways now in existence that have been constructed since 1909. This yardage, which is equivalent to 1,32[illegible] miles of 15-foot roadway, is to be found in all sections of the United States from Wisconsin to Florida, from Colorado to Massachusetts. It includes park drives, city boulevards and town streets as well as country roads. It comprises both asphaltic concrete and asphaltic macadam with broken stone and gravel. It includes the resurfacing of old macadam, brick pavements and shell roads, and construction of Portland cement concrete base, as well as the resurfacing of cement concrete roads.

Economy in Truck Tires

A little study and inspection of the Goodyear S. V. truck tire seems to indicate that in designing the tire the feature most sought for was economy to the truck owner.

The first and most noticeable item is the total absence of steel fastenings of any kind. The first cost on fastenings for a truck tire of the demountable type ranges from $3.00 to $7.00 per wheel, and on the old-style pressed-on type, the supplemental band may cost from $3.00 to $9.00 per wheel. Taking the most popular size tires, this charge for steel equipment represents about 10 per cent. of the total cost of the tire, or, in other words, the purchase of an S. V. tire can be considered as a 10 per cent. reduction in price.

When one considers that the figures given above represent a saving on only one wheel, it can easily be estimated what it will amount to on a whole truck, or, to make it even greater, on a fleet of trucks.

To go beyong the first cost figures, there is found to be an even greater economy than is at first apparent. We refer to weight. The weight of the steel fastenings in the case of a demountable

type tire, or the weight of the supplemental band in the old-style pressed-on tire, is great enough to represent an additional yearly expense of well over a hundred dollars when the cost of carrying it around is estimated at 15 cents per ton mile. The economy idea is further driven home by the fact that the additional weight referred to is not borne by the springs.

These are only a few of the points of economy in the Goodyear S. V. tire, but they are sufficient to represent quite an item in the truck owner's upkeep for the year.

Medusa Cement In Building Construction

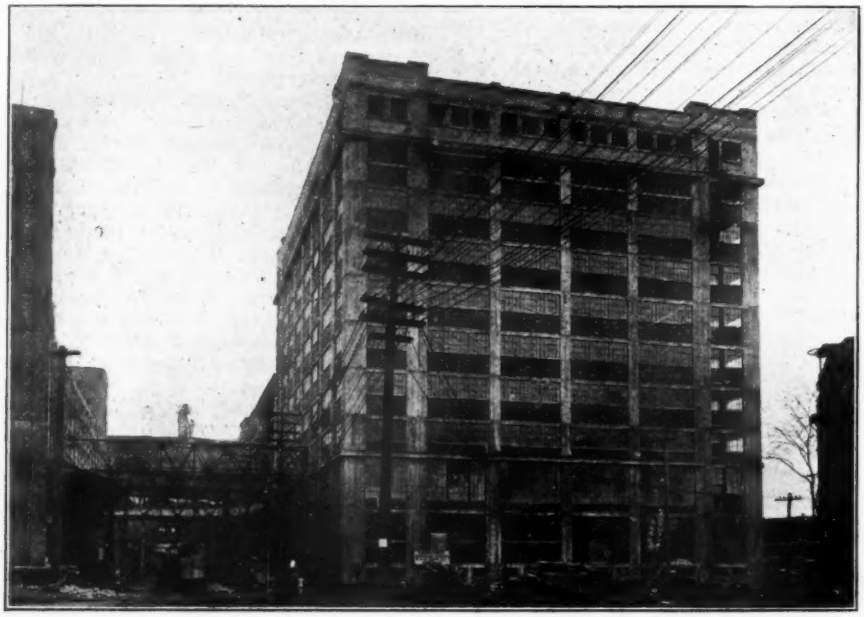
The greatest improvement in the way of new buildings that has been made in Cedar Rapids during the past year took place at the Quaker Oats plant, where nearly a round million of dollars was expended in new buildings alone. Already the largest oat meal and cereal plant in the world, the improvements this year have enlarged the big institution until the local plant now has more than double the capacity of any other similar plant in the entire world.

Some idea of the immensity of the buildings may be gained from the fact that one of the new buildings alone—the Corn Puffs structure—has 211,000 square feet of floor space, or only 9,000 feet less than five acres of space in the one building. From D avenue to the alley at B avenue there is 520 feet of solid building, containing almost ten acres of floor space. In addition to this the new eight story building on the east side of Third street contains 120,000 square feet of floor space, and is now almost completed. The new elevator and grain tanks south of B avenue have a capacity of 800,000 bushels of grain, making the total storage capacity at the plant 2,000,000 bushels.

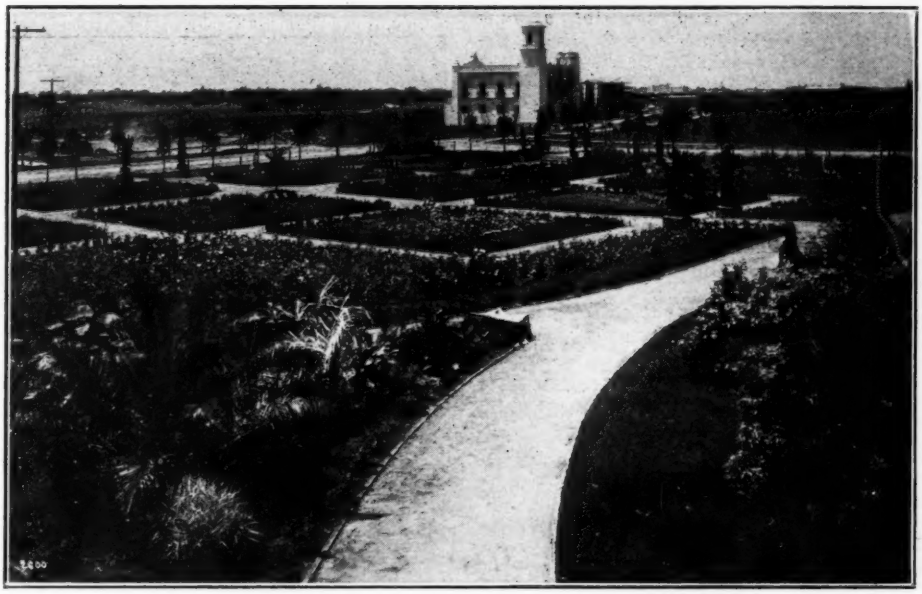
Another idea of the size of the plant may be had from the fact that when the additional machinery is installed and running, the mill will turn out 7,500 barrels of oat meal and other cereals every day, in addition to 75 car loads of stock food. To the ordinary individual it is hard to understand where this gigantic output goes, but when it is understood that the entire world is the market for Quaker Oats, puffed rice, wheat and corn the amount is not so large after all.

Warehouse No. 6, shown in the photograph, is 120x160 feet, ten stories and basement of reinforced concrete skeleton construction of the cantilever flat slab type. All floors were designed for a live load of 200 pounds per square foot with panels 20 feet square. A 75,000 gallon steel tank has been built above the roof to supply the sprinkler system for the entire plant.

Thirty thousand barrels of Medusa



REINFORCED CONCRETE WAREHOUSE *of Quaker Oats Company, Cedar Rapids, Iowa.*



PANAMA-CALIFORNIA EXPOSITION *at San Diego. A section of the grounds with the fire station in the background.*

portland cement, made by the Sandusky Portland Cement Co., were used in Warehouses No. 6 and No. 2.

Panama-California Exposition at San Diego

The park in which the Panama-California Exposition is set contains 1,400 acres, 615 of which are used by the exposition. With all this territory, it was possible to carry out the Spanish idea—using low, graceful buildings connected by arcades, with arched cloisters along the plazas and the Prado and about the quiet, flower-filled patios within the mission walls. The buildings are not crammed together, but open up here and there with vistas of broad lawns extending down to the canyons at the edge of the mesa, with glades of shrubbery and an occasional pergola. And as long as there was on hand a climate which knows frost as little as it knows torrid heat, thanks to the equalizing influence of the steady sea breeze at that southernmost tip of Uncle Sam's Pacific slope, San Diego took advantage of climate to place as many exhibits as possible out-of-doors. There are five days a year, on an average, when the sun does not shine in San Diego. What this arrangement means to fire protection is apparent.

The accompanying photograph gives a view of some of the garden and orchard space with the fire station near the center. This station has a full equipment of Seagrave motor fire apparatus and is ready for business during construction, and installation of exhibits, as well as during the exposition itself.

The Sand Blast

A paper by H. D. Gates before the Associated Foundry Foremen of New York and Vicinity, giving valuable practical points on the selection and operation of sand blast equipment from the user's viewpoint is distributed by the De la Vergne Machine Co., New York, and can be obtained for the asking.

The paper describes the apparatus and the many uses to which it is put, and gives tables of flow of air, figures of cost of work, etc., and is of interest to any engineer, especially in pointing out the uses which can be made of the apparatus.

Information About Asphalt Pavements

One of the handsomest booklets received is one entitled "Evidence" on the handsomely illuminated cover, which is amplified on the title page to read "A Volume of Evidence as to the Durability of Lake Asphalt Pavements." It is issued by the Barber Asphalt Paving Co.,

Philadelphia, Pa., and contains a very remarkable collection of facts, both figures and photographs, as to the durability and economy of Trinidad and Bermudez Lake asphalts from many cities in this country.

Some of the information has been published in MUNICIPAL ENGINEERING, but it is convenient to have as much of it collected into one booklet, so that it can easily be found and compared.

Copies will be sent by the company on request.

Specifications for Street Cleaning Machine

The squeegee street cleaning machine consists of a four-wheeled gear with platform springs on front wheels. It can be arranged with pole for two-horse team or shafts for three-horse team.

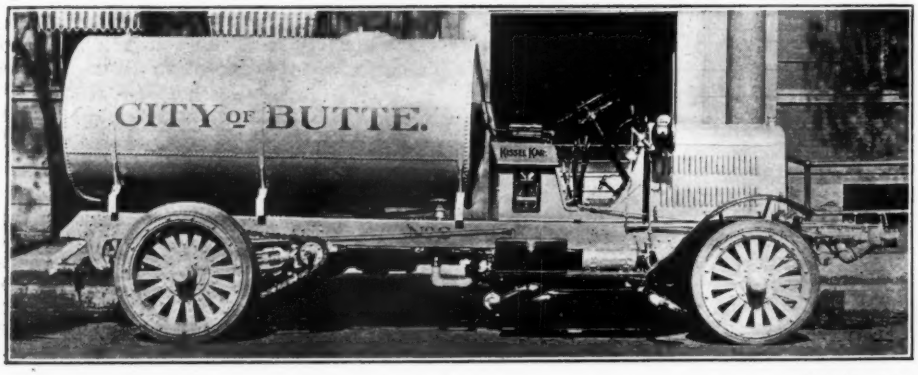
A heavy sheet iron circular shaped tank is mounted on springs on rear axle, with front of tank resting on the springs of front axle. A suitable driver's seat is placed on top of tank.

The tank has a capacity of 500 gallons of water. The water is delivered thru four perforated sprinkling pipes located between the front and rear wheels.

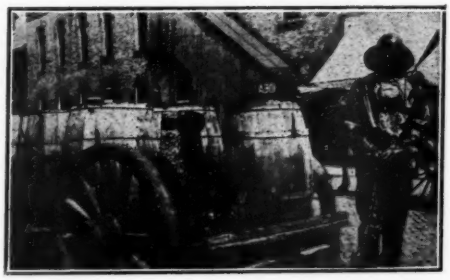
Directly back of the rear wheels and suspended from and at an angle to the rear axle is a spiral revolving rubber brush driven by gearing connected to wheel on rear axle. This brush can be removed from the surface by the driver from his seat.

The machine is furnished complete, including painting ready for operation. The weight of the outfit is approximately 3,350 pounds without water.

It is made by the Kindling Machinery Co., Milwaukee, Wis.



STREET FLUSHER AND SPRINKLER *of the city of Butte, Mont.*



TAR *in these barrels removed from sewer by turbine sewer cleaner.*

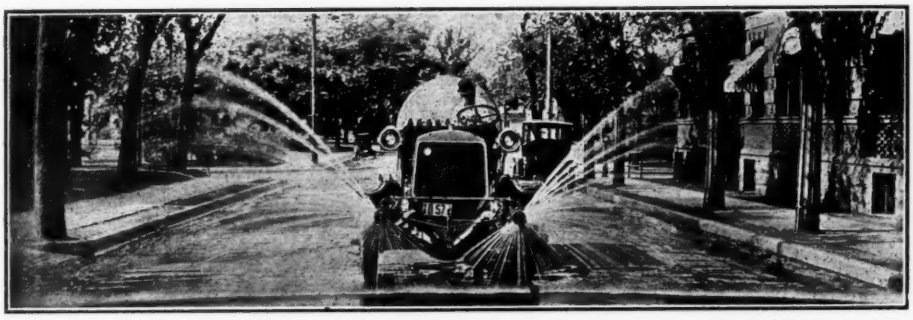
Tar Removed From A Sewer

The accompanying photograph shows a few of the fifty or more barrels of tar taken out of a sewer in Fond du Lac, Wis., with a turbine sewer cleaning machine made by the Turbine Sewer Machine Renovating Co., of Milwaukee, Wis. In some places the tar from the gas plant had accumulated 10 to 12 inches deep in a 24-inch sewer. The tar was distributed thru about 3,000 feet of sewer, but most of it was in the middle 1,000 feet.

Motor Street Sprinkler and Flusher

The accompanying photographs show the KisselKar combination street sprinkler and flusher.

The first photograph shows one owned by the city of Butte, Mont., in which can be seen the 1,000-gal. galvanized steel tank, mounted on a regular 3½-ton chassis. The water runs by gravity to a 2-stage centrifugal pump directly connected to the motor, and can be delivered at 20 to 60 pounds pressure according to the speed of the motor, the same pressure being available as long as there is any



COMBINATION STREET FLUSHER AND SPRINKLER. *One view shows the sprinkler heads in action, the other one of the flusher nozzles in operation.*

water in the tank. The pump supplies water to the sprinkler heads seen, with the connecting piping at the right in front of the car, or to the flushing nozzles, with flat delivery orifices, one of which is seen near the pavement immediately in the rear of the front wheel. The levers for operating the valves may be seen on the dash at the driver's right and the water can be turned from sprinkler to flusher in an instant by shifting a lever.

The sprinkler can sprinkle a 60-foot street from curb to curb or it can be shut down to cover any less width on either or both sides as the traffic passing or vehicles standing may require.

One tank of water will sprinkle 7 to 8 blocks of 50-foot roadway, or will flush a distance of 3½ blocks.

Two of the pictures give front views of the sprinklers operating on a rather narrow roadway and of the operation of the flushing nozzle on one side of the car on the same street. The uniform distribution of the water by the sprinklers is notable. The angle of the water from the flusher can be changed as may be desirable.

Full information about this useful piece of street cleaning apparatus can be obtained of the Kissel Motor Car Co., 554 Kissel avenue, Hartford, Wis., and from their numerous branches and representatives in all important cities.

A New Water Works Directory

The last edition of the Manual of American Water Works published by the Engineering News Co., was issued in 1897. Since that time there has been no publication to cover the field. The McGraw Publishing Co. now proposes to publish "The McGraw Water Works Directory," which for $15 will give in its 375 pages the usual data desired concerning water works, such as city, population, ownership, names of superintendent, purchasing agent, plant engineer, source of water supply, method of supply, equipment of plant, hydrants, tanks, meters, boilers, engines, etc. It will contain suitable summaries by states, indexes and whatever will be found of value to purchasers.

In conjunction with this book will be published "The Water Works Buyers' Guide and Reference Manual, which will combine with a handbook of working data, diagrams, charts, etc., a buyers' guide showing names of addresses of manufacturing concerns supplying the needs of water works men. A copy of this book

will be sent to every water works engineer and superintendent co-operating in supplying information for the Directory.

Water works men who have not received the information blanks from the McGraw Publishing Co., 239 West 39th street, New York, should send for them at once.

The books will be issued early in 1915.

Buy A Bale of Cotton

The Goodyear Tire & Rubber Company is the first of the tire companies to take up the "buy a bale of cotton" movement by which an effort is being made to move at least a part of the South's enormous cotton crop this year. Instructions have been issued to the managers of Goodyear's eight branches in the cotton belt to buy bales of cotton and to place them in the branch show windows. Each bale bears the name and address of the planter from whom it has been purchased, and in addition an exhortation to others to do likewise.

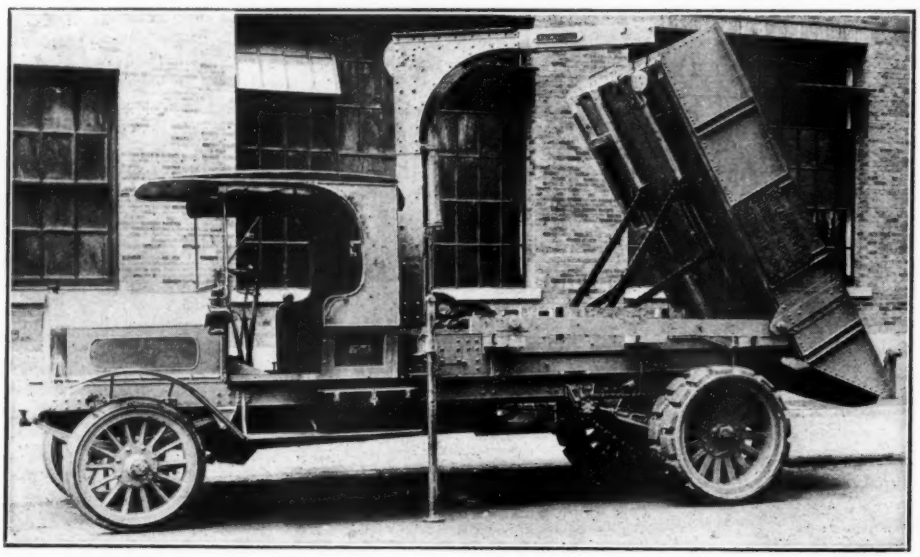
"The present situation, due to the accumulation of such a large crop with no means of selling it, may yet prove of value to Southern farmers," says a Goodyear official, who has just returned from the South. "Too much reliance has been placed by farmers on one, or at best two, staple crops. When these fail, or when they cannot be turned into cash, the farmers are left helpless. Many of them buy almost all their food products. This condition is likely to be changed as a result of this year's experience. More diversified crops and more scientific tilling is already being urged, and Northern farmers and their ideas are now more welcome in the South than ever before."

Motor Truck for Sewer Cleaning Gang

The accompanying photograph shows a 7½-ton Mack dump truck of the Bureau of Sewers, boro of the Bronx, New York, equipped with a motor-operated crane for lifting buckets of sediment from sewer manholes and depositing contents in the body of the truck. The design of this equipment is original.

Heretofore it has been necessary for a gang of men to laboriously haul a small bucket of refuse from sewer manholes by hand process, or else use a tripod derrick, which only slightly aided matters. With this truck it is possible to run the truck alongside the curb, and, with the swinging crane, raise a bucket of silt weighing 1½ tons above the sides of the body and dump it on board.

The truck has a special steel watertight dump body, with a capacity of 3½ cubic yards. The body is equipped with the Hunt dumping device. As the material to be dumped is of a quality which offers considerable resistance to gravity, the body is raised to an angle of 60 degrees.



MOTOR DUMP WAGON *for sewer gang. Note crane for lifting buckets and dumping them in the water-tight bed, here shown tipped for dumping and exhibiting the dumping apparatus.*

The hoist is manufactured by the Brown Hoisting Machinery Company, Cleveland, and consists of an upright about 8 feet above the floor of the truck, with an arm extending out, which gives the crane an effective radius of 8 feet. This crane is operated from the clutch shaft and controlled by a lever which is directly behind the cab, within easy reach of the driver. It is possible to rotate the crane by hand so that material can be picked up from either side of the truck. The crane rotates from 200 to 220 degrees. With the propeller shaft revolving at 600 the crane has an effective hoist speed of 20 feet per minute.

Wheel base of the truck is 14 feet 6 inches; front wheels, 36 inches, equipped with 36 by 6-inch Goodyear tires; rear wheels, 42 inches, equipped with 42 by 7-inch dual Goodyear tires. The motor is a 50-h.p. Mack.

A Pocket Slide Rule

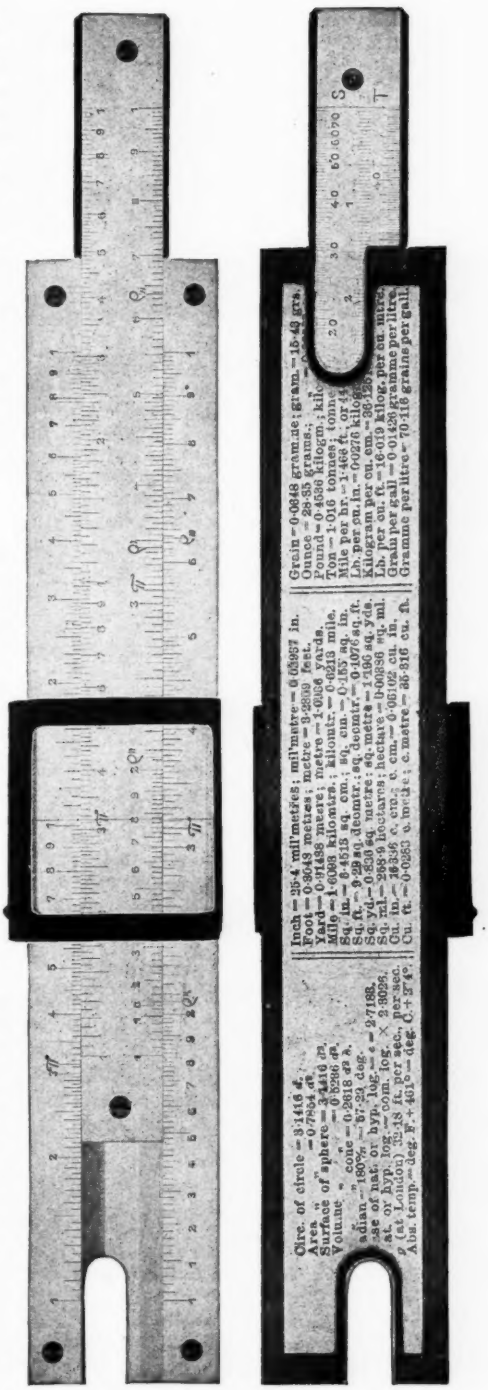
The accompanying cuts show full size the two sides of a 5-inch pocket slide rule which can be purchased of Clark T. Henderson, Box 1564, Milwaukee, Wis. Mr. Henderson began by using the rule himself and found it so convenient that he imported them for his friends and now finds himself obliged to keep it on hand in stock sufficient to meet the many inquiries for it from those who have seen it in use. A light case contains it and it is of convenient size for the pocket. Mr. Henderson will give any particulars not shown in the cuts.

Expert On Sewage Disposal

Mr. H. D. Wyllie, who has for the past fifteen years been connected with the Cameron Septic Tank Company as consulting engineer, is now in position to offer to city engineers and municipal officials a unique co-operative service which should be in demand thruout the country.

Sewage disposal involves problems which only one trained in a thoro knowledge of the subject can solve. These problems concern not only design and installation of plants, but their operation as well. Many properly designed plants have been unsatisfactory because of improper operation. Sewage disposal is a special branch of sanitary engineering which has become an important and prominent one. Many engineers have hesitated to enter this field because of a lack of information regarding the technical details and many who have attempted to give attention to it have become discouraged after a few costly failures.

Mr. Wyllie is one of the few specialists who are thoroly equipped by training and by experience to meet every requirement


Circ. of circle = 3·1416 d.
Area " " = 0·7854 d².
Surface of sphere = 3·1416 d².
Volume " " = 0·5236 d³.
" cone = 0·2618 d² h.
adian " 180° = 57·296 deg.
ase of nat. log. = 2·7183.
g (nat. log.) = 2·3026 log.
(at London) 32·18 ft. per sec. per sec.
Abs. temp. = deg. F. + 461° = deg. C. + 273°.
Grain = 0·0648 gram.
Ounce = 28·35 grams.
Pound = 0·4536 kilogm.; kilogm. = 2·2046 lbs.
Ton = 1·016 metric ton; metric ton = 0·9842 ton.
Mile per hr. = 1·468 ft. or 44 in. per sec.
Lb. per cu. in. = 0·0276 kilogm. per cu. dcmtr.
Kilogram per cu. cm. = 36·125 lbs. per cu. in.
Lb. per cu. ft. = 16·019 kilog. per cu. mtr.
Grain per gall = 0·0142 gramme per litre.
Gramme per litre = 70·116 grains per gall.
Inch = 25·4 millmetres; millmetre = 0·03937 in.
Foot = 0·3048 metres; metre = 3·2809 feet.
Yard = 0·9144 metre; metre = 1·0936 yards.
Mile = 1·6093 kilom.; kilom. = 0·6214 mile.
Sq. in. = 6·4513 sq. cm.; sq. cm. = 0·155 sq. in.
Sq. ft. = 9·29 sq. dcmtr.; sq. dcmtr. = 0·1076 sq. ft.
Sq. yd. = 0·836 sq. metre; sq. metre = 1·196 sq. yds.
Sq. ml. = 258·9 hectares; hectare = 0·00386 sq. ml.
Cu. in. = 16·386 c. cm.; c. cm. = 0·06102 cu. in.
Cu. ft. = 0·0283 c. metre; c. metre = 35·316 cu. ft.

TWO SIDES OF POCKET SLIDE RULE, *one of the necessary conveniences for ready computations.*

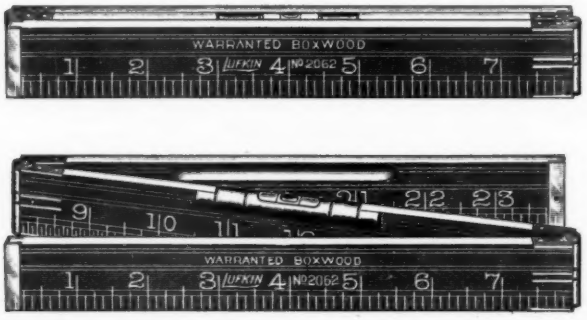
incident to the design, construction and operation of disposal plants. The hundreds of installations made under his direction in the past decade or more have demonstrated many important principles, among which are the now recognized efficiency and economy of the septic process both in first cost and in operation. His plan contemplates not only the design and construction of plants, but also a comprehensive course of practical instruction for engineers or officials who may be called upon to operate them. Mr. Wyllie's new offices are located in the Monadnock Block, Chicago.

Combination Pocket Rule and Level

This article is a 2-foot folding boxwood rule, fitted with a spirit level. The three 8-inch rule sections are each 1 inch wide, 3/16 inch thick and united by substantial brass joints. The rule is fully graduated entire length both sides, one side inches to eighths, other side to sixteenths. The spirit level is neatly set into and flush with the upper edge of the middle section of the rule, where most convenient for use, and securely protected by the two outer sections of the rule, which fold against it on either side when closed for carrying in the pocket. The combination rule and level, being light and but 8 inches long when folded, is conveniently carried in the pocket. Closing pins especially designed for the purpose hold the sections of the rule in proper alignment, insuring a perfect bearing surface.

The accuracy of the rule and level is guaranteed. The article is new in every sense of the word, and, both as rule and level, a practical tool. The Lufkin Rule Company, of Saginaw, Mich., are its manufacturers and patents are pending.

TWO VIEWS *showing the combination pocket level and rule, closed, and open to show the grooves into which the level tube fits.*



Trade Notes

Among recent contracts awarded to the Raymond Concrete Pile Co. are concrete piles for foundations of the Austin-Nichols Co., Service building, and two thirteen-story apartment houses at Broadway, 84th street and West End avenue., New York; foundations of factory building for the Fifty Associates Co., Toledo, O., and foundation of the Y. M. C. A. building, Canton, O.

The Detroit Sanitary Closet Co., Detroit, Mich., is introducing the sani-spray" apparatus for flushing the seat of a water closet as well as the closet itself, which has a rubber wiper bar to remove surplus water when the cover is lifted.

W. H. Stewart, the manufacturer of sewer rods and a sewer cleaning machine, is now located at 415 Dorchester avenue, Boston, Mass.

Contracts for the concrete pile foundations of the following structures have been awarded to the MacArthur Concrete Pile & Foundation Co.: Grain bins and elevator, Stanard Tilton Milling Co., Alton, Ill.; bakery for Ward Baking Co., East Orange, N. J.; weave shed, Salt's Textile Manufacturing Co., Bridgeport, Conn.; the Portland (Maine) Gas Light Co. will erect a 1,500,000 cubic foot gas holder. The foundation consisting of 576 pedestal concrete piles and a 12-inch concrete mat.